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Heavy Minerals of the Citronelle Formation of the Gulf Coastal Plain.

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HEAVY MINERALS OF THE CITRONELLE FORMATION OF THE GULF COASTAL PLAIN

A Dissertation

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by
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ABSTRACT

The heavy minerals of the Citronelle Formation and fluviatile terraces of Louisiana were examined to determine the source area of these sediments. Examination of samples indicates that an East Gulf Province heavy mineral suite (kyanite, staurolite, zircon, tourmaline), typical of the Cretaceous and Tertiary sediments of the Gulf Coastal Province, is present throughout the Citronelle and older Louisiana terrace deposits. A Mississippi River Province suite (epidote, amphibole-pyroxene, garnet), presumably derived from the glacial sediments of the northern United States, is present in the Recent Mississippi River sediments (Russell, 1937), and in the younger terraces: the Holloway Prairie, Port Hickey, and Irene.

Based on data determined in this study and previous work, the Citronelle Formation appears to represent an alluvial apron formed by coalescing, braiding streams, in response to epeirogenic uplift of the continental interior during Late Pliocene to preglacial Pleistocene time. Encisement of the Mississippi River and other streams into Citronelle sediments has resulted in entrenched valleys containing fluviatile terraces which are mineralogically and lithologically similar to the Citronelle but are at a lower elevation. Younger terrace deposits bearing a Mississippi River Province heavy mineral suite are believed to have formed in response to fluctuating sea level during Pleistocene glacial times.

INTRODUCTION

General Statement

Along the southern margin of the Gulf Coastal Plain, coarse sands and gravels cap stream interfluves, forming much of the highlands. These deposits were described by many early workers and were the subject of comprehensive mapping and discussion by Matson (1916), who named them the Citronelle Formation.

The age and origin of these deposits have been the center of much debate. At the present time, there are two main divergent hypotheses. The one elaborated by Fisk (1939b) states that Coastal Plain stream valleys were entrenched during Pleistocene glacial stages and that sands and gravels were deposited during Pleistocene interglacial stages as fluviatile deposits in the entrenched valleys and as deltaic plains along the coast; the source of the sediments was thought to be the glacial outwash deposits in the northern United States. The hypothesis of Clendenin (1896) and Doering (1956) suggested that the Citronelle represents a Late Pliocene to preglacial Pleistocene blanket fluviatile deposit, derived from the Cretaceous and Tertiary clastic deposits of the Gulf Coastal Plain and ultimately derived from the Appalachian Province.

Enough work has already been done by other workers to indicate that the two suggested source areas posess completely different heavy mineral suites. The Gulf Coastal sediments are characterized by a nonopaque heavy mineral suite dominated by kyanite, staurolite, zircon, and tourmaline. The glacial and Recent Mississippi River deposits are characterized by amphibole-pyroxene, epidote, and garnet.

This information can be used to test the hypotheses in the following manner: if the sands and gravels were derived from glacial outwash, they should contain a heavy mineral suite dominated by amphibole-pyroxene, epidote, and garnet; if, on the other hand, the sands and gravels were derived from the Gulf Coastal clastic sediments, then they should contain a heavy mineral suite dominated by kyanite, staurolite, zircon, and tourmaline.

This report presents the results of a comprehensive heavy mineral study of the Citronelle Formation from southwestern Mississippi to the Florida Panhandle (see Figs. 1 and 2) and a brief examination of the heavy minerals of the fluviatile terraces of Louisiana (see Fig. 3). The purposes of the investigation have been: (1) to describe the major suites of heavy minerals present in the Citronelle and terrace deposits, and to determine whether significant subsuites are present; (2) using the above information locate the source of the sediment now comprising these deposits; (3) consequently, to suggest which of the above hypotheses can account for these deposits; (4) additionally, to study the textural parameters of the Citronelle sediments in order to establish better the nature of their depositional agents

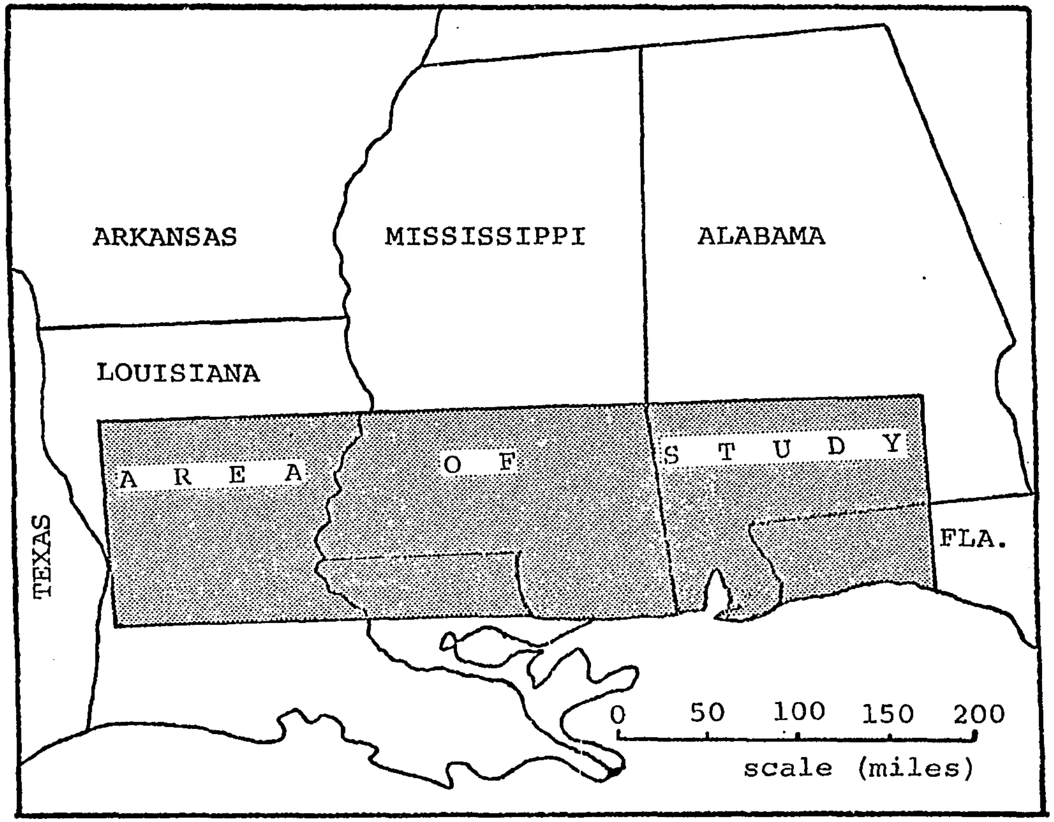

Figure 1: Index map of area studied.

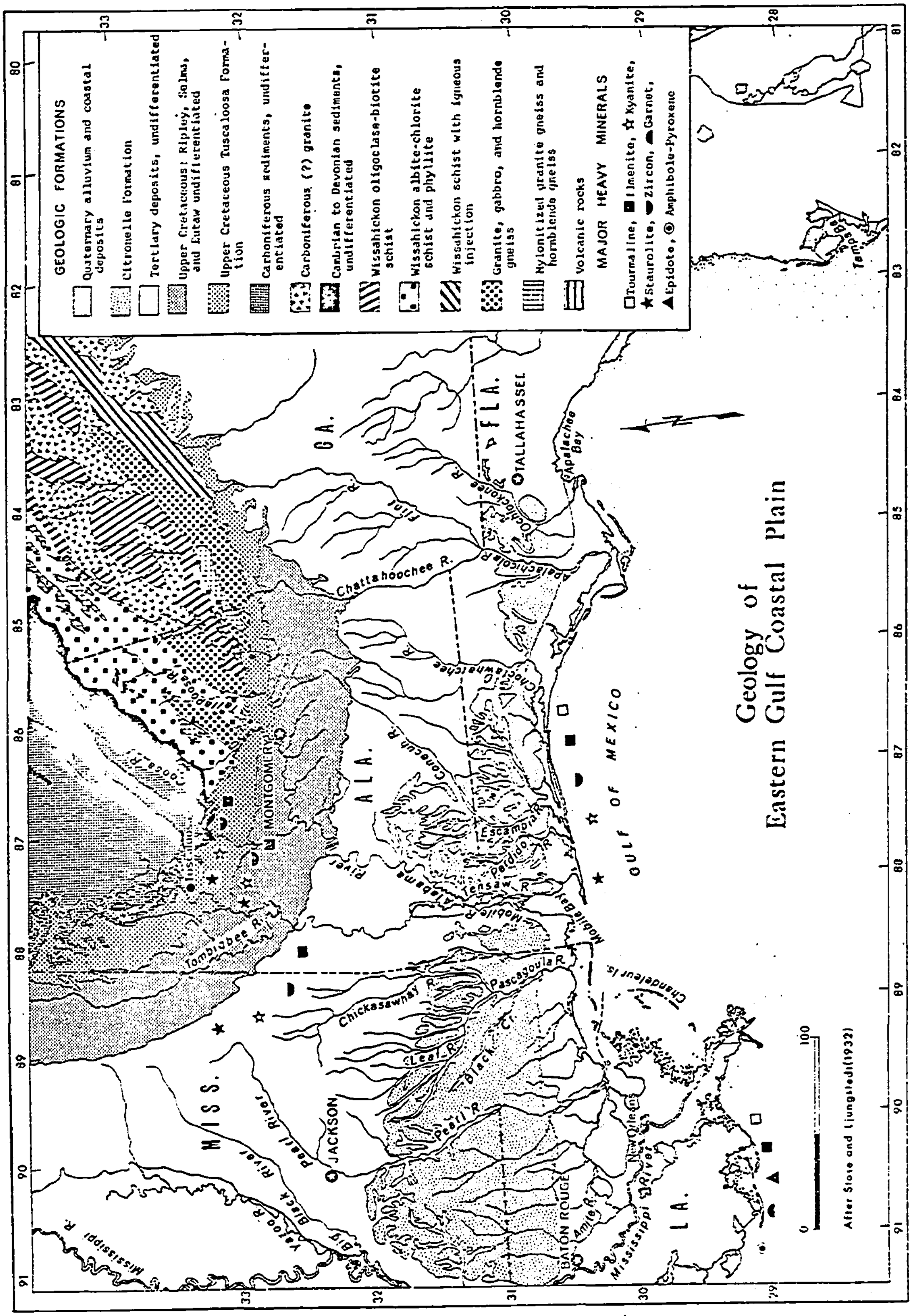
Geology of
Eastern Gulf Coastal Plain
GEOLOGIC FORMATIONS
Quaternary alluvium and coastal deposits
Citronelle Formation
Tertiary deposits, undifferentiated
Upper Cretaceous: Ripley, Selma, and Eutaw undifferentiated
Upper Cretaceous Tuscaloosa Formation
Carboniferous sediments, undifferentiated
Carboniferous (?) granite
Cambrian to Devonian sediments, undifferentiated
Wissahickon oligoclase-biotite schist
Wissahickon albite-chlorite schist and phyllite
Wissahickon schist with igneous injection
Granite, gabbro, and hornblende gneiss
Mylonitized granite gneiss and hornblende gneiss
Volcanic rocks
MAJOR HEAVY MINERALS
Tourmaline, Ilmenite, Kyanite, Staurolite, Zircon, Garnet, Epidote, Amphibole-Pyroxene
MISS.
ALA.
GA.
FLA.
LA.
JACKSON
MONTGOMERY
TALLAHASSEE
BATON ROUGE
N. Orleans
GULF OF MEXICO
Apalachee Bay
Tampa Bay
Mobile Bay
Chandeleur Is.
Mississippi R.
Yazoo R.
Big Black River
Pearl River
Pearl R.
Leaf R.
Black Cr.
Chickasawhay R.
Pascagoula R.
Tombigbee R.
Alabama River
Mobile R.
Tensaw R.
Perdido R.
Escambia R.
Conecuh R.
Choctawhatchee R.
Chattahoochee R.
Flint R.
Apalachicola R.
Ochlockonee R.
Tallapoosa R.
Coosa R.
Amite R.
Mississippi River
0 100
After Stose and Ljungstedt (1932)

Figure 2

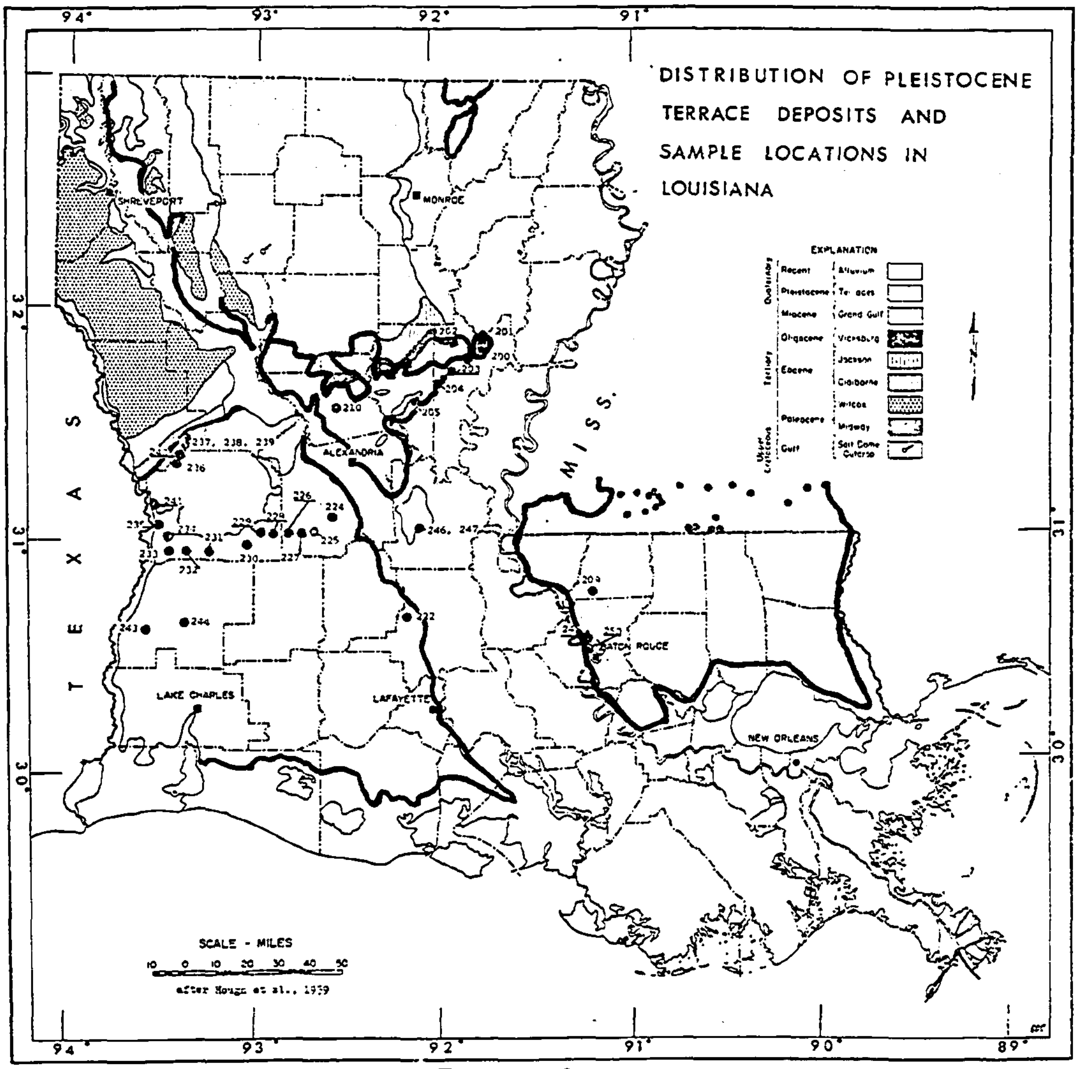
DISTRIBUTION OF PLEISTOCENE TERRACE DEPOSITS AND SAMPLE LOCATIONS IN LOUISIANA
EXPLANATION
SHREVEPORT
MONROE
ALEXANDRIA
LAKE CHARLES
LAFAYETTE
BATON ROUGE
NEW ORLEANS
TEXAS
MISS.
SCALE - MILES
after Hough et al., 1939

Figure 3

Descrption of the Citronelle Formation

The Citronelle Formation extends from Alabama and Florida to Texas, generally near the seaward margin of the Gulf Coastal Plain (see Figs. 2, 3, 4a, and 4b); Doering (1960) has suggested that it also is present along the southern margin of the Atlantic Coastal Plain. The Citronelle Formation is underlain by Tertiary silts and clays; this contact is marked by a regional unconformity which gains magnitude inland. In the northern and central portion of the outcrop belt, thick sands and gravels cap interfluves and form the topographically high areas. The Citronelle has a surface thickness of about 150 feet (Doering, 1956, p. 1852), and dips southward beneath Pleistocene coastwise formations which overlap it unconformably. Fluviatile equivalents of the Pleistocene deposits extend northward as terrace deposits in major stream valleys, entirely across the Citronelle outcrop belt. Near the Mississippi River, deposits of loess unconformably mantle the Citronelle and older Tertiary deposits (Snowden, 1966).

The Citronelle Formation consists of coarse- to fine-grained quartz sands, commonly with pebbles and granules. These deposits are generally massive, but occaisionally exhibit cross-bedding and other sedimentary structures. The boundaries between depositional units are either gradational within a short distance or erosional. These depositional units vary greatly in size so that some extend horizontally across the outcrop while others terminate

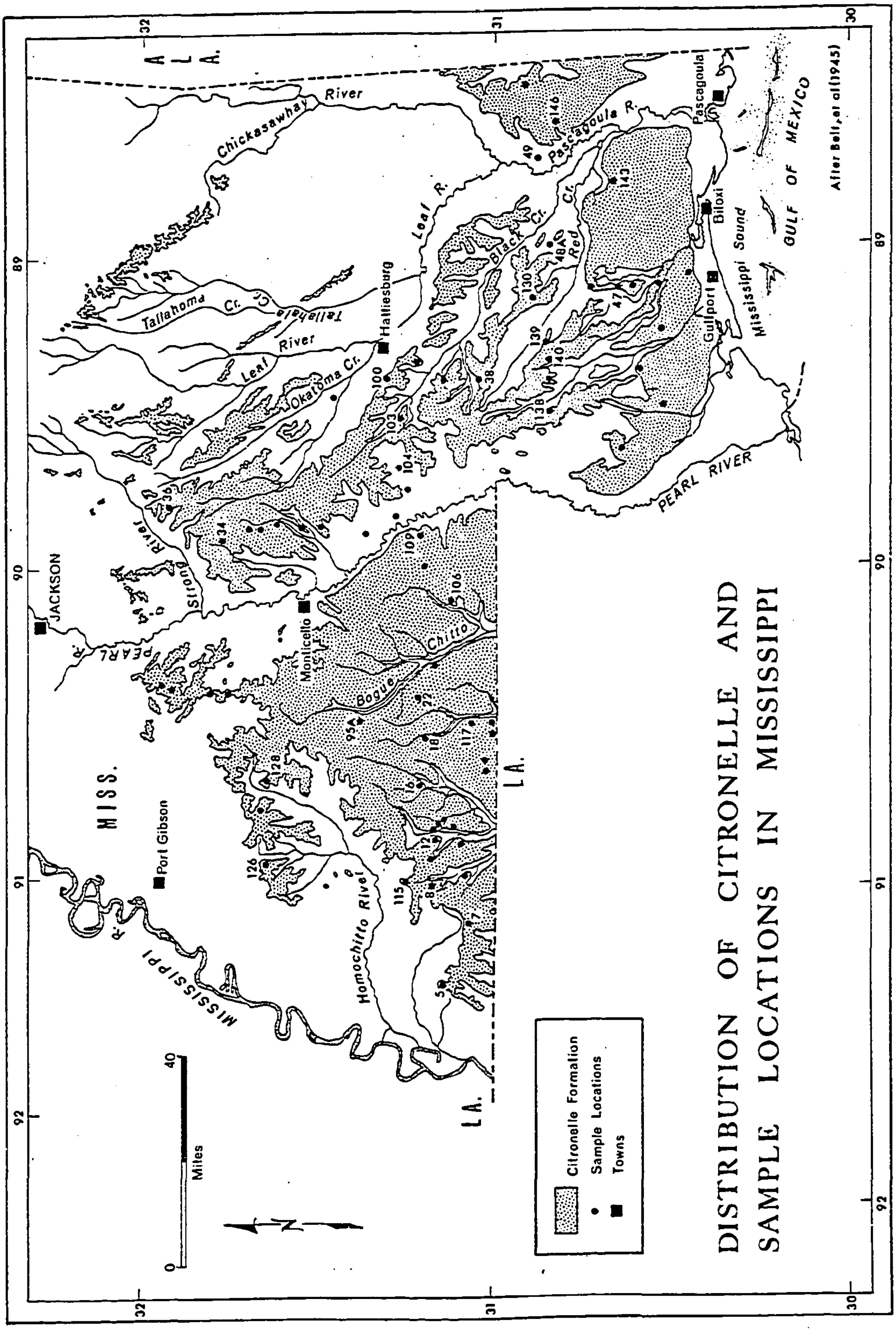
DISTRIBUTION OF CITRONELLE AND
SAMPLE LOCATIONS IN MISSISSIPPI
Citronelle Formation
Sample Locations
Towns
Miles
After Bell, et al (1945)
MISS.
LA.
ALA.
GULF OF MEXICO
Mississippi Sound
JACKSON
Port Gibson
Monticello
Hattiesburg
Gulfport
Biloxi
Pascagoula
PEARL RIVER
Pearl R.
Mississippi R.
Homochitto River
Bogue Chitto
Strong River
Leaf River
Okatoma Cr.
Tallahoma Cr.
Tallahala Cr.
Chickasawhay River
Pascagoula R.
Black Cr.
Red Cr.

Figure 4a

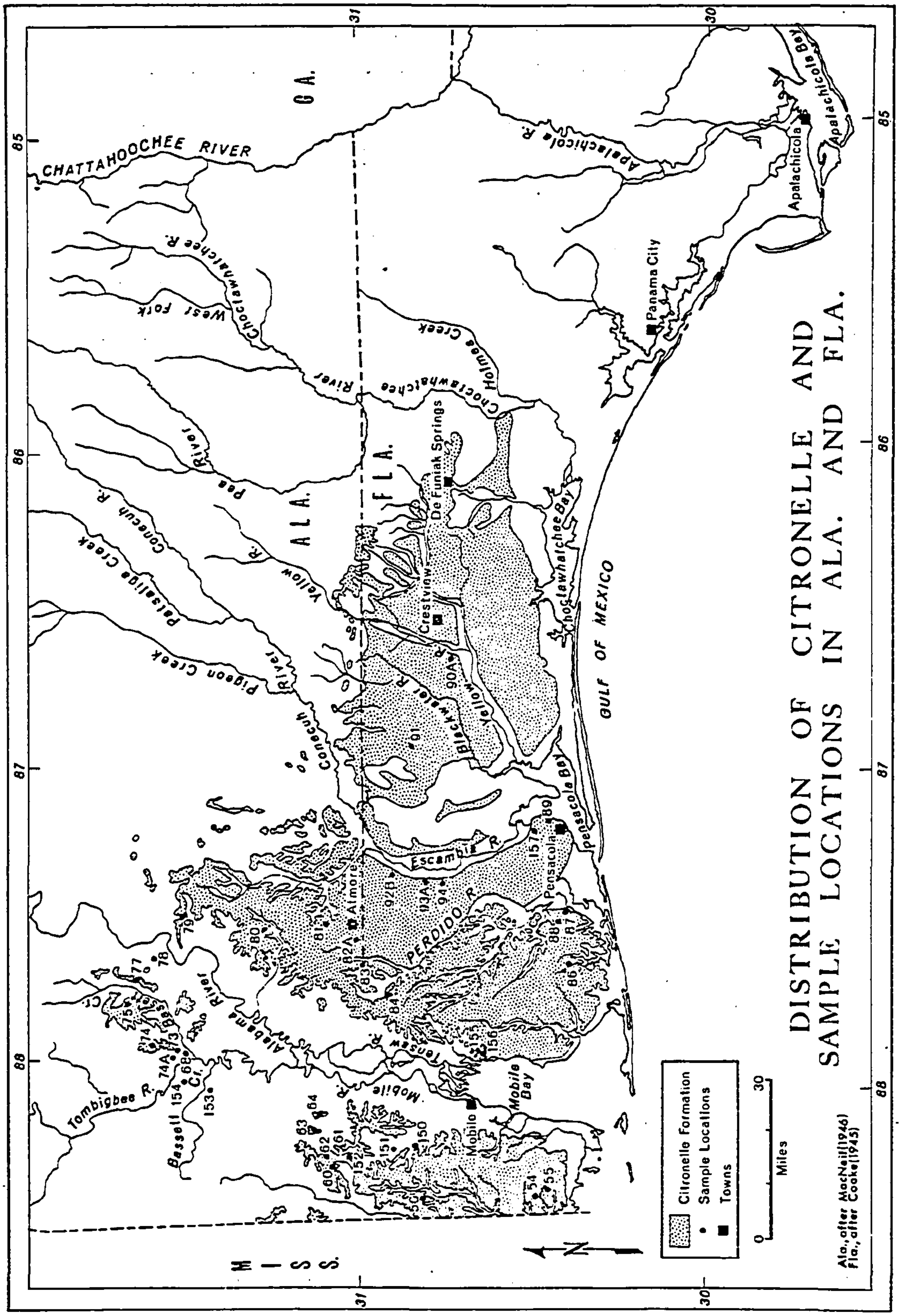
DISTRIBUTION OF CITRONELLE AND SAMPLE LOCATIONS IN ALA. AND FLA.
Citronelle Formation
Sample Locations
Towns
Miles
Ala., after MacNeil (1946)
Fla., after Cooke (1945)
GULF OF MEXICO
ALA.
FLA.
GA.
MISS.
CHATTAHOOCHEE RIVER
Pensacola
Mobile
Crestview
De Funiak Springs
Panama City
Apalachicola
Almore

Figure 4b

within the outcrop. Layers of sandy, clayey silt several inches thick are present but not common. These finer-grained units display sharp upper and lower boundaries, and in some areas appear to be traceable for several miles from one exposure to another. Clay balls are commonly present in the sands which overlie these clayey silt zones.

In frsh outcrops, the sands and gravels of the Citronelle are grey-white in color, but older weathered outcrops are colored orange by secondary ferruginous stain and cement. Zones of hard pan several inches thick also are present in many of the older exposures. Generally, the hard pan is concentrated along the boundary between two depositional units of contrasting grain size distribution.

No detailed studies of the pebbles of the Citronelle Formation have been made. Field observations, however, by Matson (1916), Brown (1967), and the writer have indicated that the Citronelle pebbles in western Mississippi are dominantly chert with some quartz; many of the chert pebbles contain mid-Paleozoic crinoid and bryozoan remains. In western Louisiana, the pebbles also are dominantly chert but not fossiliferous. East of central Mississippi, the pebbles are dominantly quartz with some unfossiliferous chert. In the granule size range, quartz and chert dominate; some pieces of very fine-grained sandstone or coarse silt, and, rarely, igneous and metamorphic rock fragments also are present. While Fisk (1939a) related these crystalline granules to source areas in the upper Mississippi

Valley, the same types also are found in the southern Appalachian region. The granules do not seem to show an apparent east-west compositional change. It is probable that useful information about source material could be found by a more detailed study of this size fraction.

Gravel-sized material is common but not present everywhere in the Citronelle outcrop belt. Small boulders with a maximum longest dimension of 10-12 inches are present in a few localities but are not common. Brown (1967) suggested the presence of gravel trains in the Citronelle. More detailed mapping, however, is necessary before this hypothesis can be determined valid.

Previous Work

Summary of the Term Citronelle

Upon weathering, many of the sands of the Gulf Coastal Plain become bright reddish orange in color. Thus Safford (1856) included the sediments now considered Citronelle in his "Orange Sand Group" based on work in Tennessee and extended into neighboring states by Hilgard (1866, 1869, 1873). The term was inadequate, however, as it included sands of the same color which ranged in age from Cretaceous to Pleistocene.

The Citronelle sediments were then included in Hilgard's (1891) Lafayette Formation, named for its type locality in Lafayette County in northern Mississippi. Although the Lafayette was considered by most workers to be Pliocene in age, Berry (1911) subsequently found Eocene leaves in the deposits of the type locality. Since 1915, the Lafayette has not been considered a valid formational term.

Matson (1916) mapped nonmarine sands and gravels as the Citronelle Formation in the Gulf Coastal Plain, and he considered them to be Pliocene in age. Matson selected the town of Citronelle, Alabama, as the type locality based on excellent exposures along the Gulf, Mobile, and Ohio Railroad north of the town.

Age and Origin

Fisk developed a complete hypothesis concerning the age and origin of Late Cenozoic sands and gravels. In a report describing Grant and LaSalle parishes, Louisiana, he (1938a) named and described four fluviatile terraces in the Red and Mississippi River valleys. From oldest to youngest he named them Williana, Bentley, Montgomery, and Prairie. While noting the difficulty of correlating terrace deposits with sediments in other regions, Fisk (1939b) made correlations between his fluviatile terraces and their coastal equivalents (i.e., deltaic plains). Although Fisk (1940, 1944) assigned Citronelle deposits to the Williana Formation, a comparison of Fisk's (1944) and Matson's (1916) maps shows that he also included some Citronelle sediment in the Bentley and Montgomery Formations.

Fisk postulated that glacial stages were periods of erosion along the Gulf Coast as rivers entrenched in in response to falling sea level. As sea level rose during the interglacial stages, rivers aggraded, filled their newly cut valleys, and formed deltaic plains as they entered the transgressing Gulf of Mexico. Downwarping of the Gulf Coast geosyncline was associated with structural uplift and tilting along its northern flank, where these deposits were transformed into fluviatile and coastal terraces. Fisk maintained that the oldest surface, the Williana, was tilted and uplifted the most, while the youngest surface, the Prairie, was affected the least (see Fig. 5).

Since these studies, the fluviatile terraces and their coastal equivalents have been mapped in many other Louisiana parishes by various workers (e.g., Huner, 1939; Welch, 1942; Holland, Hough, and Murray, 1952; Martin et al., 1954; Varvaro, 1957; Andersen, 1960).

An opposing viewpoint has been developed by Doering. In southwestern Louisiana and Texas, he (1935) mapped as the Willis Formation sands and gravels which he considered Pliocene in age. In 1956, Doering correlated the Willis and the Citronelle and obected to Fisk's correlation of the Williana and Citronelle. Doering's Figure 4 (p. 1834) indicated that if Fisk were correct, a large structural depression would exist in central Louisiana which would be eliminated if the Williana were equivalent to the Lissie Formation which he considered younger than the Citronelle. Further, maps of the underlying Miocene deposits show no structural depression.

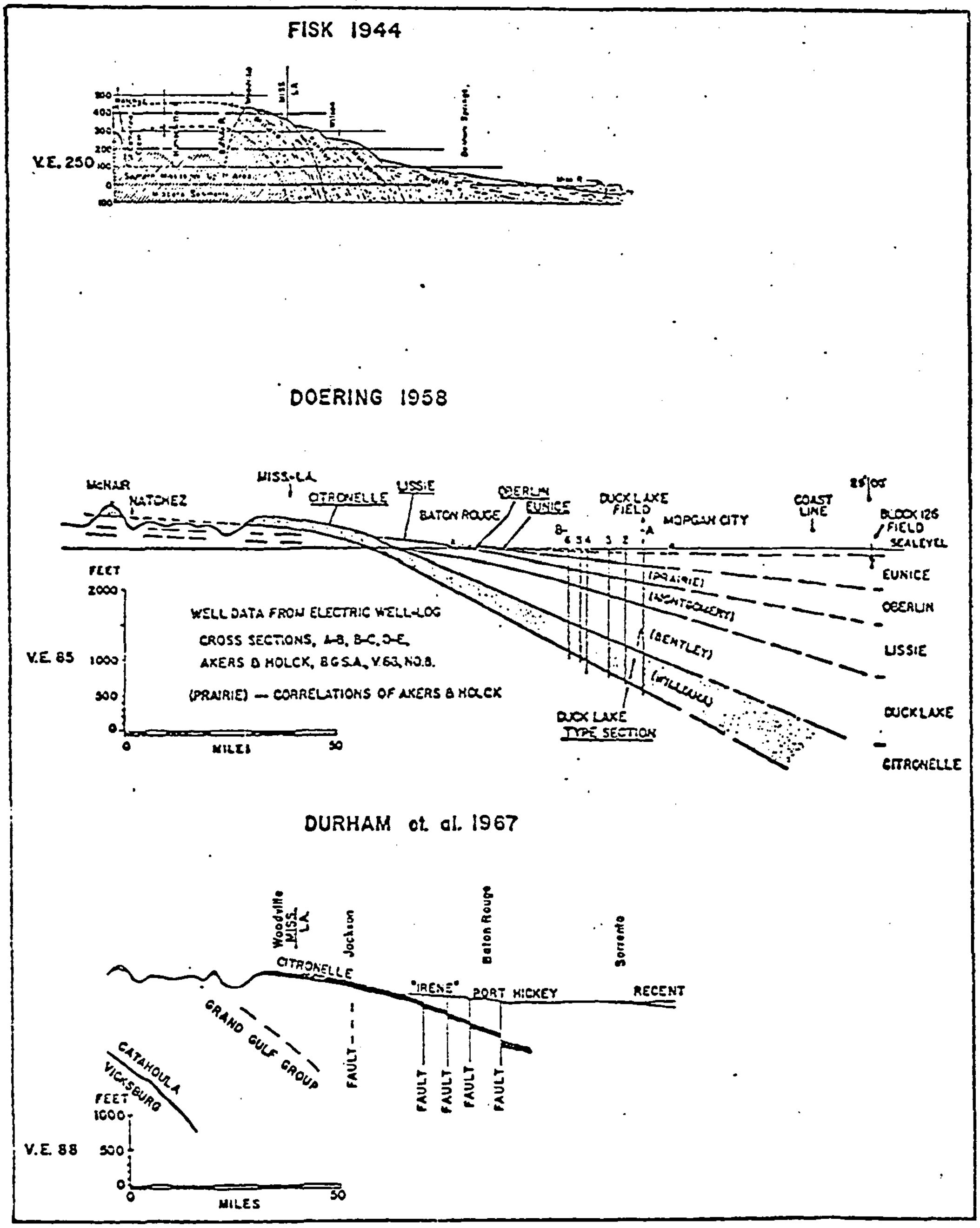

Figure 5: Contrasting concepts of terrace relationships demonstrated by cross-sections from near Natchez southward to south Louisiana (after Durham, Moore, and Parsons, 1967, Figure 3).

Doering (1958) felt that the Citronelle represented an alluvial apron which formed as a result of preglacial epeirogenic uplift of the continental interior. A similarhypothesis was first suggested by Clendenin (1896), who felt these deposits ranged from Late Pliocene to Early Quaternary in age and suggested that uplift in the continental interior resulted in stream rejuvenation, increased erosion, deposition of the sands and gravels, and perhaps contributed to the onset of glaciation.

A detailed confirmation of Doering's hypothesis was supplied by Parsons (1967) who traced the Citronelle Formation from southwestern Mississippi southward into Louisiana, an area which had been considered by Fisk (1939b) as Williana, Bentley, and Montgomery, and by Doering (1956) as Citronelle and Lissie (see Fig. 5). Because of the continuity of the deposits as shown from the shallow subsurface information, obtained from closely spaced auger holes, Parsons felt that only one formation, the Citronelle, was present. He also suggested that the Citronelle represented an alluvial plain built by braiding, coalescing streams crossinga gently sloped coastal plain.

The older workers were also in disagreement as to the significance of the gravels and sands. Hilgard (1866) suggested that they were a "southern drift", correlative with the northern glacial drift. McGee (1891) considered these deposits to be Pliocene in age and marine in origin, a view also suggested by Harris and Veatch (1899). Matson (1916) considered the Citronelle deposits in part estuarine, in part shallow water deposits at or near the strand line where there was some wave action (beach?), but dominantly fluviatile. Matson felt that the strand line had fluctuated several times and that upward movement of the land was the most probable cause.

Matson believed the Citronelle to be Pliocene in age primarily on the basis of plant fossils, identified by Berry, 1916, thought to be in the basal portion of the formation. Doering (1935), Fisk (1938a), and Roy (1939), however, disagreed. They felt the fossils belonged to an underlying formation separated from the Citronelle by an unconformity. Matson's viewpoint was subsequently upheld by Stringfield and LaMoreaux (1957) because Citronelle-like sands are found below the fossil-bearing beds, and because fossil leaves present in another locality in the basal portion of the Citronelle. Doering (1958), however, noted that the fossils only indicated a preglacial age which at the time of Berry was believed to be Pliocene, but that the definition of the Pleistocene by the 18th International Geologic Congress, summarized in Moore (1949), included a preglacial section in its European type locality.

Correlation Problems of Younger Terraces

Similar problems of correlation have been encountered in studies of the younger terraces in the Gulf Coast region. A complete discussion of these problems is beyond the scope of this report. However, because it must be determined when Mississippi River heavy minerals first entered the Gulf region, a brief description of these controversies in the Mississippi River area is presented.

In southwest Louisiana, Doering (1956) concluded that because Fisk's coastwise Prairie terrace is higher in elevation and has a steeper slope than Fisk's fluviatile Prairie terrace, the coastwise terrace is older and should be correlated with Fisk's Montgomery fluviatile terrace. Consequently, he renamed the fluviatile type Prairie the Holloway Prairie, and the coastwise Prairie the Eunice (which he correlated with the fluviatile Montgomery; see Table 1). Progressively older coastwise terraces the Oberlin and Lissie were correlated with the fluviatile Bentley and Williana, respectively.

In southwest Louisiana, Doering also mapped Lissie, Oberlin, and Eunice coastwise terraces south of the Citronelle terrain. The Eunice-Oberlin contact, however, is actually the Baton Rouge fault escarpment of Durham and Peebles (1956). Parsons (1967) recognized only two post-Citronelle coastwise terraces in this area (see Fig. 5). Realizing the uncertainty that was still present in regional terrace correlations, Durham, Moore, and Parsons (1967)

Red River Area (Fisk, 1940)	Doering, (1956)	La. Coastal Area (Fisk, 1940)
Prairie	Holloway Prairie	------
Montgomery	Eunice	Prairie
Bentley	Oberlin	Montgomery
Williana	Lissie	Bentley
------	Citronelle	Williana

Table 1: Revised correlation chart of Doering (after Doering, 1958).

suggested using local terminology for these two terraces. They informally named the older terrace "Irene" for an excellent exposure in northern East Baton Rouge Parish, Louisiana. They called the widespread younger surface the Port Hickey, a name used first by Matson (1916) for these deposits, although earlier both Durham (1964) and Parsons (1967) had applied the name Beaumont on the basis of supposed correlation with the Beaumont of southwest Louisiana (Fisk's coastwise Prairie and Doering's Eunice).

Heavy Mineral Studies in Gulf Coast Province

Studies of the heavy minerals of various deposits in the Gulf Coastal Plain and Mississippi Embayment have been done in the past. Figure 2 summarizes the distribution of heavy minerals in units in or near the area of the present study. A more detailed discussion of such work is necessary to understand better how heavy minerals can be useful in determining the source of the sediments now in the Citronelle and terrace deposits.

Russell (1937) described the heavy minerals of the Mississippi River deposits. The most abundant are magnetite, ilmenite, pyroxene, amphibole, epidote, and garnet. Kyanite reaches a maximum of one per cent in one sample but it is rare (under one per cent) or absent in others. Staurolite is also rare or absent (see Fig. 6).

Analyzing Recent sediments in the northern Gulf of Mexico, Goldstein (1942) distinguished four major hravy mineral provinces, two of which are of importance to this

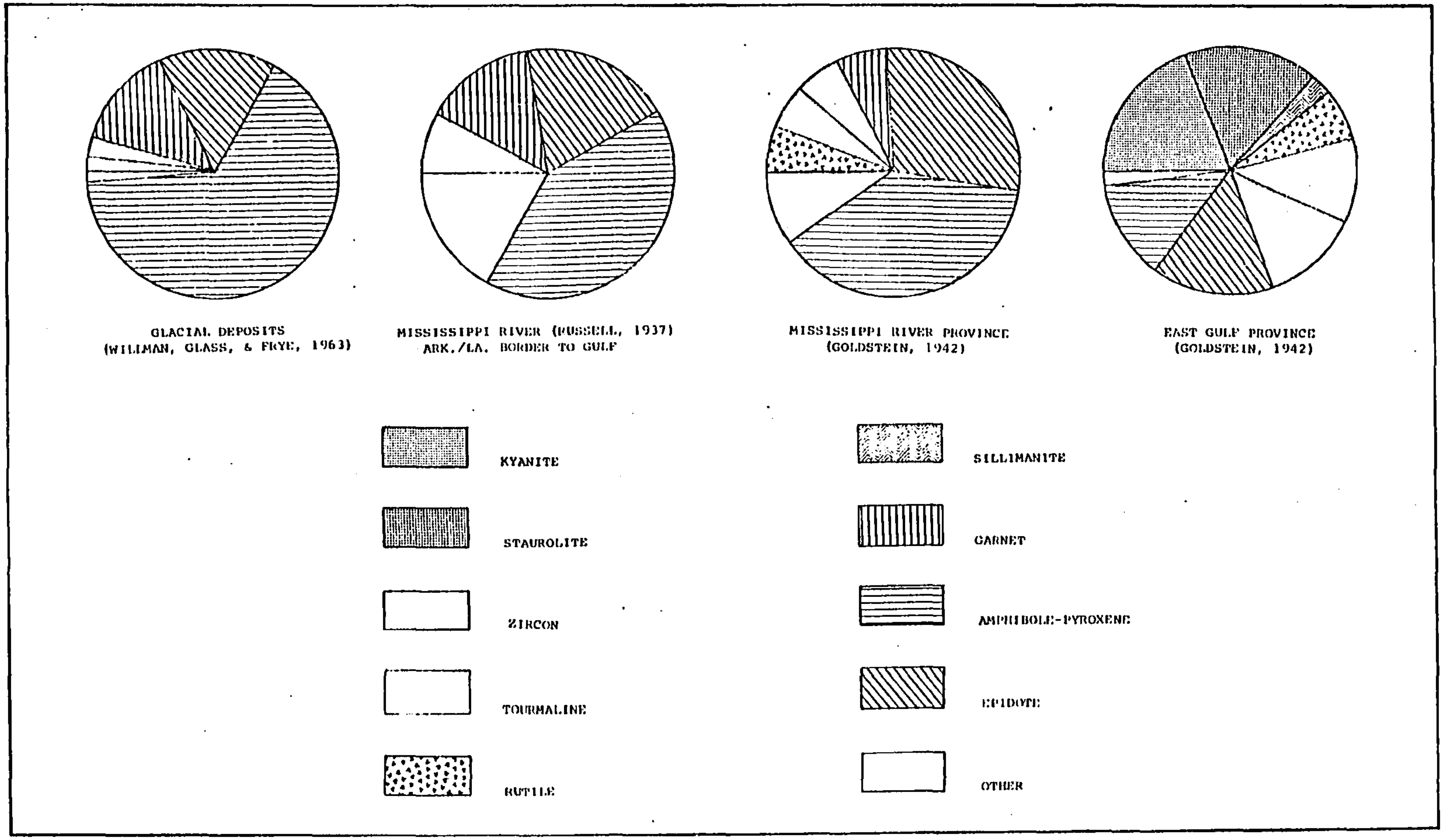

Figure 6: Contrasting source area heavy mineral suites.

study. The Mississippi River province assemblage was found from the Chandeleur Islands (about Long. 88° 45') westward to Vermilion Bay (about Long. 92° 30'). This area encompasses the Recent Mississippi River deltaic deposits. The Chandeleur Islands comprise reworked sands of the Mississippi River St. Bernard subdelta whose outer boundary represents the most eastern extent of Recent Mississippi River deltaic deposition; the western boundary is marked by the Salè-Cypremort subdelta. This assemblage is characterized by, in order of abundance, amphiboles, dolomite, pyroxene, epidote, ilmenite, biotite, tourmaline (see Fig. 6; dolomite is not included because all samples were treated with acid). The eastern Gulf Province includes the area east of the Chandeleur Islands to at least Long. 86°. This province is characterized by ilmenite, staurolite, zircon, kyanite, tourmaline, and sillimanite (see Fig. 6). The percentages of magnetite, amphiboles, garnet, and pyroxene are low; Goldstein (p. 81) felt that these differences were due to the nature of the source rock than to chemical instability since grains of both provinces show little signs of alteration.

Wilman, Glass, and Frye (1963) reported the heavy minerals of the glacial deposits in Illinois as amphibole-pyroxene, epidote, and garnet (see Fig. 6). As Potter and Pryor (1961) showed that the Paleozoic rocks which the Mississippi River drains contain a limited suite of zircon, tourmaline, and some garnet, the glacial deposits may be assumed to be the main source of heavy minerals for the Mississippi River. Some contribution, however, may be made by the Tennessee River as its upper tributaries drain a zone of epidote and hornblende-bearing rock (compare map of upper Tennessee drainage with Fig. 1 of Overstreet and Griffitts, 1955).

Bornhauser (1940) wrote the first comprehensive report of the heavy mineral zones of the Tertiary sediments of western Louisiana and eastern Texas based on samples from well cores. Cogen (1940) had access to Bornhauser's data and additional samples. Because of the latter, Cogen's classification of heavy mineral zones is more nearly complete than Bornhauser's. Cogen recognized four heavy mineral zones which transect formational boundaries; three zones are present in the subsurface and only one, the Kyanite zone, is present in the surface Tertiary deposits of western Louisiana. This zone is characterized by kyanite, staurolite, zircon, tourmaline, and rutile. Work by Levert (1959) and Dixon (1963) indicated that the Kyanite zone is present in all of the surface Tertiary deposits of Louisiana.

Grim (1936) made a comprehensive heavy mineral study of the Eocene formations of Mississippi. Sun (1954) reexamined the Jackson (Upper Eocene) sediments of Mississippi and also of western Alabama. Blankenship (1956) described the heavy minerals in the 2.0-3.0ϕ size range of Midway (Paleocene) outcrops, Wilcox (Lower Eocene) outcrops and well cuttings, and Claiborne (Middle Eocene) well cuttings in Tennessee. The major heavy minerals reported in all of these studies are kyanite, staurolite, ilmenite, zircon, and tourmaline, with lesser quantities of sillimanite and rutile. Garnet is present in some samples (reaching a maximum of 8.0 per cent in one sample) but is generally absent or less than one per cent.

Pryor (1960) described the heavy minerals of the Gulfian (Cretaceous) basal deposits of the Mississippi Embayment, and reported a typical southern Appalachian kyanite-staurolite-zircon-tourmaline heavy mineral suite. Farther southeast the only Cretaceous heavy mineral study was on the Tombigbee Sand (Upper Eutaw Formation) by Needham (1934), who reported epidote, garnet, and tourmaline as the dominant heavy minerals. Pryor believed these minerals were typical of all Cretaceous deposits of that region, apparently because no study reported otherwise. The writer collected sand samples along a traverse from Centreville southward to Marion, Alabama, of the Tuscaloosa Formation, the McShan Formation, the Eutaw Formation, and the Tombigbee Sand. The heavy minerals present in all of the samples were quite similar and belonged to Goldstein's East Gulf Province (kyanite, staurolite, zircon, tourmaline). The writer knows of no explanation for Needham's results.

Application of Heavy Mineral Analysis

The intention of this study to utilize heavy mineral distribution in determining source area for the Citronelle and terraces has already been discussed. However, the variation of heavy minerals in a sediment is a function of several factors, and it is necessary for this study to eliminate all of these factors except one: variation associated with source area (or provenance). Besides provenance, some of the factors which must be considered are: (1) differential physical stability during transport, (2) differential chemical stability to weathering and intrastratal solution, and (3) physical sorting of mineral species with differing specific gravity and size distributions. Fisk (1951, p. 342) suggested that these factors make the heavy minerals in these deposits useless for reflecting their source. The following discussion, however, indicates that this statement was unnecessarily pessimistic.

Possible effects of differential physical stability can be estimated by comparing mineral hardness with mineral abundance. The data which are presented in detail later indicate that this factor has not significantly affected the heavy mineral species.

Differential chemical stability can be examined by comparing the estimated chemical stability of heavy minerals present with their abundance, by examining the heavy minerals from unweathered localities with the heavy minerals from weathered exposures, and by examining the heavy minerals present for chemical attack. In the Citronelle, the most abundant heavy minerals are not the most stable chemically. Of the approximately 130,000 nonopaque grains examined, tourmaline showed the greatest amount of attack in one or two grains per slide, but these grains are at least third cycle. Too, as the following data show, there is essentially no change in heavy mineral populations between localities with no secondary iron present and between localities which are semi-indurated by secondary iron.

Supporting evidence of the unimportance of this factor on these deposits is found in the studies of the other units in the Gulf Coast region. The presence of garnet and epidote in the Tertiary sediments of this region makes it unlikely that weathering or intrastratal solution would have removed this minerals completely from the younger deposits. The inability of intrastratal solution to remove hornblende in a friable Claiborne sand has been reported by Callender (1957). Finally, other workers in this region (e.g., Goldstein, 1942; Todd and Folk, 1957, Potter, 1955a, 1955b; and Pryor, 1960) agree that the heavy minerals of the units that they have studied have been relatively unaffected by secondary changes. Therefore, the assumption seems justified that the heavy minerals in the Citronelle Formation and the terrace deposits reasonably reflect their parentage.

The third factor is more complex and difficult to eliminate. Rubey (1933) was able to show that sedimentary particles of a small volume but high specific gravity behave hydraulically the same as grains of lower specific gravity and larger volume, assuming the minerals have similar shapes. For this relationship, Rubey used the term hydraulic equivalence. Hydraulic equivalent size would be the diameter of a quartz grain qhich would settle with a heavy mineral. Rittenhouse (1943) was the first to attempt calculation of hydraulic equivalent size from field data. He found that for any one heavy mineral the hydraulic equivalent size varies nonuniformly with the size of the mineral grain, and that for any given size class there is a difference in the hydraulic equivalent size between heavy minerals of different specific gravity. While sieving of a sample helps reduce the effect of the former, it does not reduce the effect of the latter.

One means of eliminating the hydraulic problem is to consider only heavy minerals which have similar specific gravity and shape. This requires the minerals to have a similar size distribution in the sediment and similar hydraulic equivalent size values. In addition, if the minerals have similar chemical and physical stability, these additional sources of variation can be reduced or eliminated. If all of the above conditions are met, the only variation left is source area. If 'x' equals the number of grains of one mineral present and 'y' equals the number of grains of another mineral of the same size with similar hydraulic equivalent size, the numerical ratio x/x+y expresses their relationship as a ratio. Significant differences in the ratio value can be detected by analysis of variance (ANOV), provided replicate counts are made to estimate internal variation. If one mineral (or one group of minerals) is from one source area and the other mineral (or group) is from another source area, an estimate can be made of the contribution of each source area. In addition, subsuites based on contributions of different ratios of two minerals which are found in one major suite can be defined.

The best example of the above technique is varietal counts of a single mineral within the same size fraction because the varieties have the same equivalent size. It must be proven, however, that the varieties chosen are diagnostic of different source material and they must be present in enough quantity to be usable. In this study, varietal counting was not a usable technique. For example, several varieties of staurolite based on color and inclusions are present; but these varieties were duplicated in the laboratory simply by crushing a single megascopic crystal of staurolite. Krynine (1946) showed that tourmaline varieties can be useful for provenance study; but in the Citronelle, tourmaline is not sufficient quantity to be subspeciated. Similar problems arose with the other heavy minerals present, and it was therefore necessary to base the numerical ratio on two different minerals.

FIELD PROCEDURE

In the Citronelle terrain east of the Mississippi River, a series of east-west and north-south lines of localities were established with an approximate distance of 5-10 miles between localities (see Fig. 4a and 4b, based on state geologic maps and MacNeil, 1945). In Louisiana, an attempt was made to collect from pertinent terrace localities of various ages so that this procedure was not always followed (see Fig. 3, based on the state geologic map). Because of the large area involved, only road cuts and gravel pits were examined. Localities where samples were collected are indicated by black circles in Figures 3, 4a, and 4b, and localities whose samples were examined in the laboratory are indicated by locality number. Appendix I lists all localities from which samples were collected.

At all exposures, the surface of the outcrop was first scraped clean, and an attempt was made to distinguish sedimentation units which were essentially homogeneous with respect to grain size and primary structures. Channel samples of each different unit were taken, in an effort to obtain a representative sample for that unit. To insure that all particle sizes were represented, the quantity of sample taken varied with the size of the largest particles present (large for gravel, smaller for sand). No material was taken from zones of hard pan.

The younger fluviatile deposits, in part derived from the Citronelle Formation, look much like fresh Citronelle material. Most of the natural Citronelle exposures, however, are stained red and can be easily distinguished from the younger material. When confusion could exist between fresh Citronelle and younger deposits, no samples were taken.

TECHNIQUES OF LABORATORY INVESTIGATIONS

Mechanical Analysis of Citronelle Samples

For unconsolidated samples, the most commonly used methods for determining grain size distribution are sieve analysis of the sand fraction and pipette analysis of the silt and clay fraction. Because secondary iron causes some induration, however, it was necessary to treat the samples with acid before analysis could be made. Since the acid affected some of the clay minerals, the true grain-size distribution of the fine fraction could not be determined with any degree of reliability.

To estimate the importance of the silt and clay fractions (material less than 4.0ø), three iron-free samples of obviously different grain size distribution were dry-sieved. The reults from all three tests indicated that the silt and clay fractions comprise less than 4.0 per cent by weight of any fresh sample. In addition, it was noted that the amount of material present less than 4.0ø in size was related more to the degree of weathering of the outcrop than to the grain size of the deposit.

With the above factors in mind, the following procedure was used:

Samples from each unit were passed through a No. 5 (4 mm, -2.0Ø) sieve; this was necessary as a sample splitter capable of passing the very coarse material was not available. The material remaining on the sieve was washed, dried, and then sieved through a nested sequence of -5.0Ø, -4.0Ø, -3.0Ø, -2.5Ø, and -2.0Ø sieves, using a CENCO-Meinzer sieve shaker for 15-20 minutes at an intensity setting of 6-8. Each sieve fraction was then weighed ±0.05 gm. Any material passing through the -2.0Ø sieve was added to the sand fraction.

The sand fraction was then split with an Otto-type sample splitter. Each split was resplit and quarters from the right and left side were recombined to reduce bias. In this manner, the sample was reduced in size until two replicate samples of each unit, weighing 300-700 gms., were obtained. Each replicate was placed in HCl (diluted 1:3) and heated to boiling. After cooling, the acid was neutralized, and the finer than 4.0Ø material was removed by wet-sieing.

After drying, the replicate samples were sieved through a series of nested screens at 0.5Ø intervals, using a CENCO-Meinzer sieve shaker as described above. Each sieve residue was weighed to ±0.05 gms. The 80 mesh (2.0-2.5Ø) and 120 mesh (2.5-3.0Ø) splits were retained for heavy mineral analysis.

Cumulative curves were constructed for each replicate sample from the recorded data. Because the weight of the material on the sieves greater than 4 mm. represented the total weight collected in each sample, the weight of the residue on each of the -2.0Ø and larger sieves were successively divided by two for every split of the finer material. The weight thus calculated was then used as part of the data for constructing cumulative curves. The various percentiles needed for textural plots were taken from the cumulative curves. The data obtained from all replicate splits are given in Appendix II and III.

Heavy Mineral Analysis Procedures

An initial survey of 16 samples on an east-west line from western Mississippi to Florida was made to determine what heavy minerals are present in the Citronelle. These samples were treated as described under mechanical analysis except (1) replicate samples were not analyzed, (2) the samples were sieved into three whole phi (3.0-4.0Ø, 2.0-3.0Ø, 1.0-2.0Ø) size classes. Eighteen samples of the terrace deposits were then examined to determine the heavy mineral assemblage present. These samples were treated as described under mechanical analysis except that replicate samples were not analyzed. The size classes 2.0-2.5Ø and 2.5-3.0Ø were examined.

The heavy minerals were separated from the 'light' fraction using bromoform (sp. gr.=2.85), following the procedures outlined in Krumbein and Pettijohn (1938). The heavy minerals were mounted on glass slides with Lakeside 70-C. If more residue was present than could be mounted on a single slide, a micro-sample splitter was used in the same manner described under mechanical analysis. The slides were point-counted using a point-counting mechanical stage and the first 200 non-opaque grains (not including mica) were identified with the aid of a petrographic microscope. The ratio of nonopaque to opaque grains in the Citronelle was determined on the basis of the first two hundred grains encountered. To insure that no grain was counted twice, the distance between points on a traverse across the slide was slightly greater than the longest dimension of the largest nonopaque grain on the slide. The determination of the numerical ratio between minerals with similar hydraulic equivalent size is discussed in the Heavy Mineral Data Analysis section of this report.

PRESENTATION OF DATA

Textural Data Analysis

Depositional environments previously suggested for the Citronelle range from near the strand line to fluviatile. The use of textural parameters to distinguish sedimentary depositional environments is a common technique (see Folk, 1966, and Friedman, 1967, for summaries). The parameters used are generally based on mean grain size, standard deviation (sorting), and the asymmetry of the curve about the mean (skewness) because these parameters are believed to reflect the nature of the depositional agent.

Because different sedimentary environments yield overlapping values for any single parameter, Friedman (1967) tried scatterplots of two parameters. While overlap was not eliminated, it was reduced and Friedman found twelve combinations useful for distinguishing beach and river deposits. None of the twelve appeared to be more effective than another, and for this study two plots were selected as representative of the method for use in plotting data derived from mechanical analysis. These are (1) inclusive graphic skewness (SK_I; Folk and Ward, 1957) versus graphic standard deviation (σ_I; ibid), and (2) simple skewness measure (α_S; Friedman, 1967) versus simple sorting measure (SO_S; ibid).

The formulas for calculating the various parameters are givin in Table 2. Figures 7 and 8 are scatterplots of SK_I vs σ_I, and α_S vs SO_S, respectively.

MEASURE	SYMBOL	FORMULA
Inclusive graphic skewness	(SK_I)	$\frac{\phi_{16}+\phi_{84}-2\phi_{50}}{2(\phi_{84}-\phi_{16})} + \frac{\phi_5+\phi_{95}-2\phi_{50}}{2(\phi_{95}-\phi_5)}$
Inclusive graphic standard deviation	(σ_I)	$\frac{\phi_{84}-\phi_{16}}{4} - \frac{\phi_{95}-\phi_5}{6.6}$
Simple skewness measure	(α_s)	$(\phi_{95}+\phi_5) - 2\phi_{50}$
Simple sorting measure	(SO_s)	$\frac{1}{2}(\phi_{95}-\phi_5)$

Table 2: Formulas for statistical parameters used in this study.

Figure 7: Scatterplot of Sk_I versus σ_I

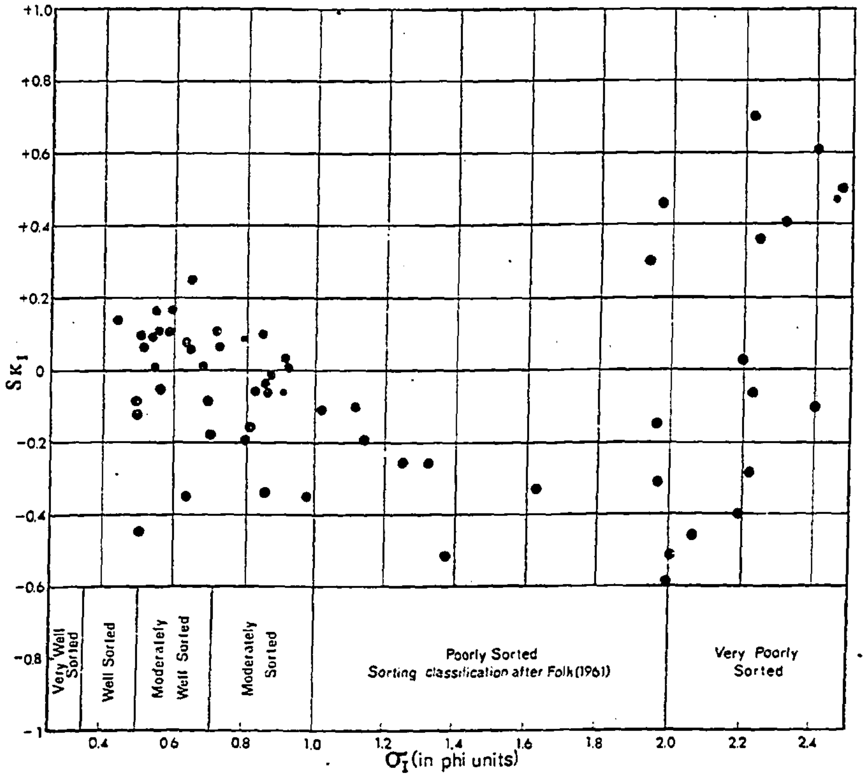

Figure 8:Scatterplot of α versus SO_s

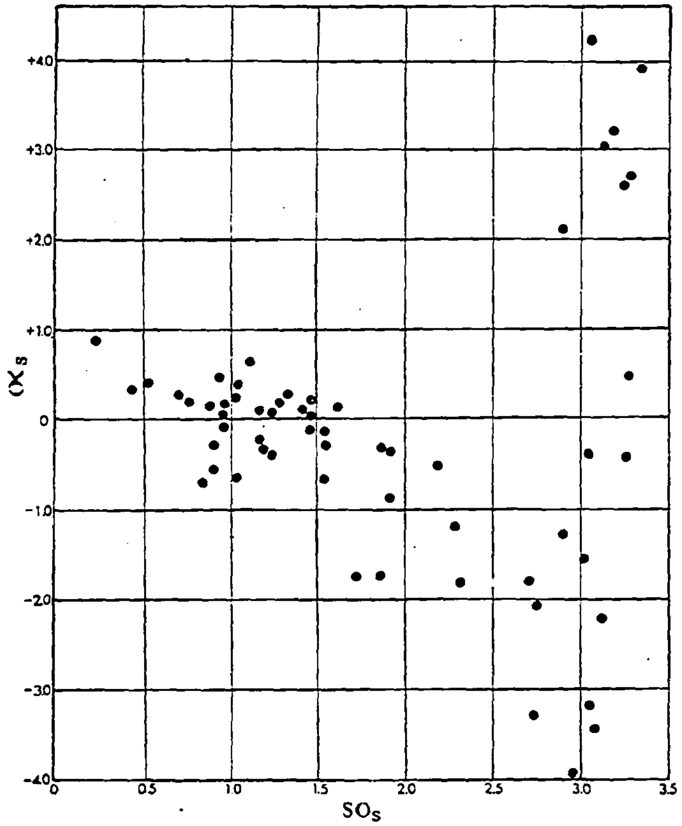

Figure 7 shows two clusters of points. In one, the sediments range from moderately well sorted to moderately sorted and $SK_I = \pm 0.25$. The second cluster is characterized by a wide range of skewness values and are very poorly sorted; the two clusters appear to be connected by a scattering of points in the poorly sorted region of the graph. Folk (1961, p. 45) notes that most Texas river deposits range in sorting from 0.4ϕ to 2.5ϕ, a range matched by the Citronelle data. Friedman (1967, p. 340) Figure 15 plots SK_I vs σ_I for known beach and river deposits. While there is a small overlap, a river-beach boundary is indicated; most of the Citronelle data plot on the river side of the boundary. The very poorly sorted cluster does not show on Friedman's diagram as he plotted values of σ_I only to 1.40. Figure 8 yields much the same information and may be compared to Friedman's (p. 342) Figure 18. The above data plots indicate that the Citronelle probably represents fluviatile deposits.

Description of Heavy Minerals Present

Citronelle Formation and Older Terraces

An initial examination of 16 Citronelle samples indicated that the heavy minerals present belong entirely to the East Gulf Coastal Province assemblage of Goldstein (1942). No one mineral is missing from any of the size classes (see Fig. 9) so that any size class can be used to describe the assemblage present. An examination of 18 Louisiana samples indicated a similar assemblage in samples from the Citronelle and three older terraces as defined by Fisk. The common heavy minerals of this assemblage in approximzte order of abundance are: ilmenite, mica, kyanite, staurolite, zircon, tourmaline, rutile, and sillimanite; magnetite fluctuates highly but is never really abundant. Other minerals which are present but not common include andalusite, garnet (spinel?), amphibole, pyroxene, epidote, sphene, and monazite. The percentages found are listed in Appendix IV. A description of the important heavy minerals follows:

Ilmenite: Ilmenite is the dominant heavy mineral in all Citronelle samples. Ilmenite occurs as opaque greyish black subrounded to subangular equidimensional grains. Most grains are coated with a white alteration product, leucoxene, which consists of fine-grained rutile. A reddish orange color can be seen in the thin edges of some grains.

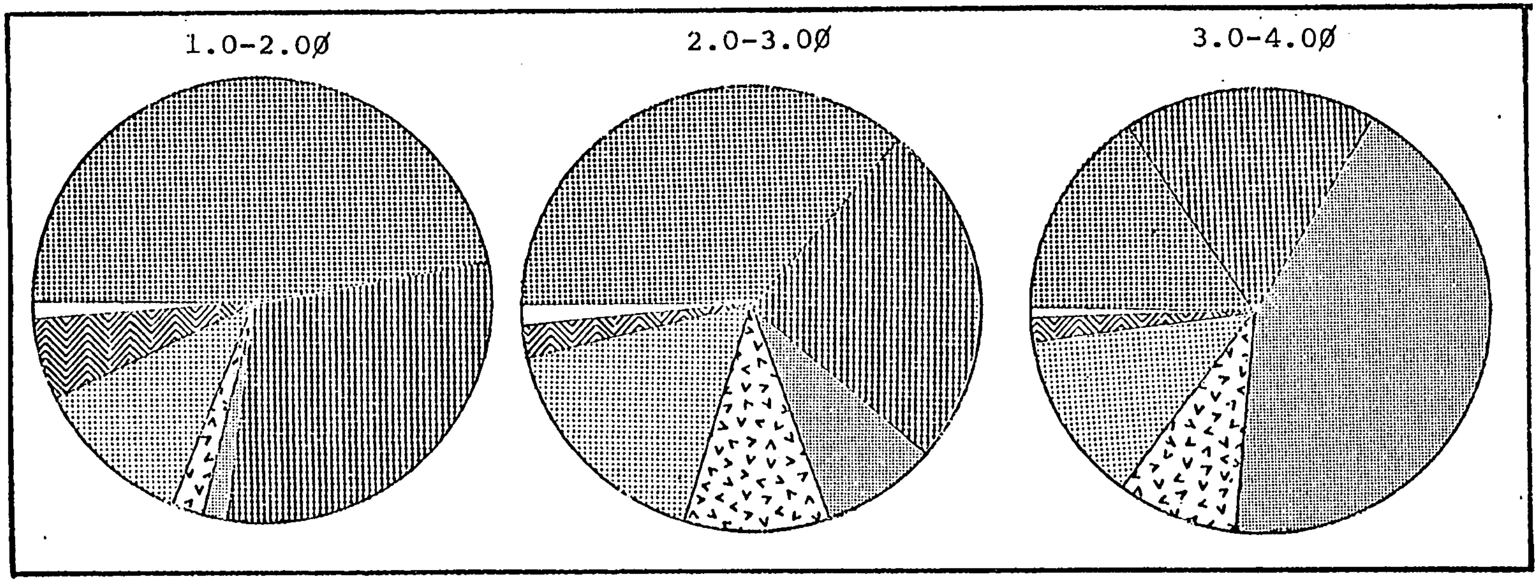

Figure 9: Nonopaque heavy minerals in 3 size classes in the Citronelle Formation.

Rutile: Deep reddish brown, generally rounded grains, and deep yellow subrounded to angular prisms and crystals of rutile are present. Deer, Howie, and Zussman (1962, p. 38) report rutile as a common alteration product of ilmenite and other titaniferous minerals. In the Citronelle and terrace samples, the alteration of ilmenite to the reddish brown variety of rutile can be seen in some grains. It is not clear, however, whether all of the reddish brown variety of rutile has formed by this process or whether the alteration which is present occurred before or after deposition. The deep yellow variety is always free of inclusions and is certainly detrital.

Kyanite: Most kyanite grains are typically bladed and range from angular to subrounded in habit; however, some are short, stumpy, and rounded. Some grains show anomalous extinction, probably due to air trapped along cleavage planes.

Staurolite: Staurolite grains may be equidimensional but more commonly are crudely prismatic to, sometimes, almost bladed. These grains range from subrounded to angular. The color varies from reddish brown to yellowish brown to straw yellow. The degree of pleochroism varies from moderate in the more colored varieties to almots none in the straw yellow grains. Most grains have no inclusions, but those with carbonaceous inclusions or quartz and other minerals (i.e., 'Swiss cheese' texture) are common too.

Zircon: Zircon grains range from well rounded equidimensional grains to angular prisms; the former are the only type present in the larger size grades while the latter are very common in the smaller size grades. As xenotime is indistinguishable from colored zircon under the microscope (Milner, 1962, p. 202-203), some xenotime also may be present.

Tourmaline: Tourmaline is present as subangular to rounded prisms to nearly equidimensional grains. The most common varieties are pleochroic yellowish brown to black and pleochroic reddish brown to black; other types are present but not common.

Sillimanite: Sillimanite most commonly occurs as fibrous grains but slender arcuate prisms and short stubby prisms are not uncommon. The latter type look much like kyanite but are distinguished by their lower relief and parallel extinction.

Mica: Almost all of the mica present is muscovite; grains of phlogopite are rare. The quantity of muscovite varies considerably in the samples examined, being abundant in some and almost absent in others.

Younger Louisiana Terrace Deposits

As the older terrace deposits contained the east Gulf Province heavy mineral suite and the Recent Mississippi deposits contained a completely different heavy mineral suite and the Recent Mississippi River deposits contained a completely different heavy mineral suite is present. Again, nomenclatural and correlation problems created difficulties. Although this was to be only a survey of these deposits, an attempt was made to collect samples from pertinent localities. Thus localities 246-247 were taken from the Avoyelles Prairie where Pleistocene Mississippi River meander scars indicate the source. This area is Fisk's Prairie type locality. These samples contained a Mississippi River Province heavy mineral suite and are summarized in pie diagram form in Figure 10. A sample of the Port Hickey fluviatile terrace, taken in St. Francisville, Louisiana, on the east side of the Mississippi River Valley, and a sample of the Irene terrace from Irene,

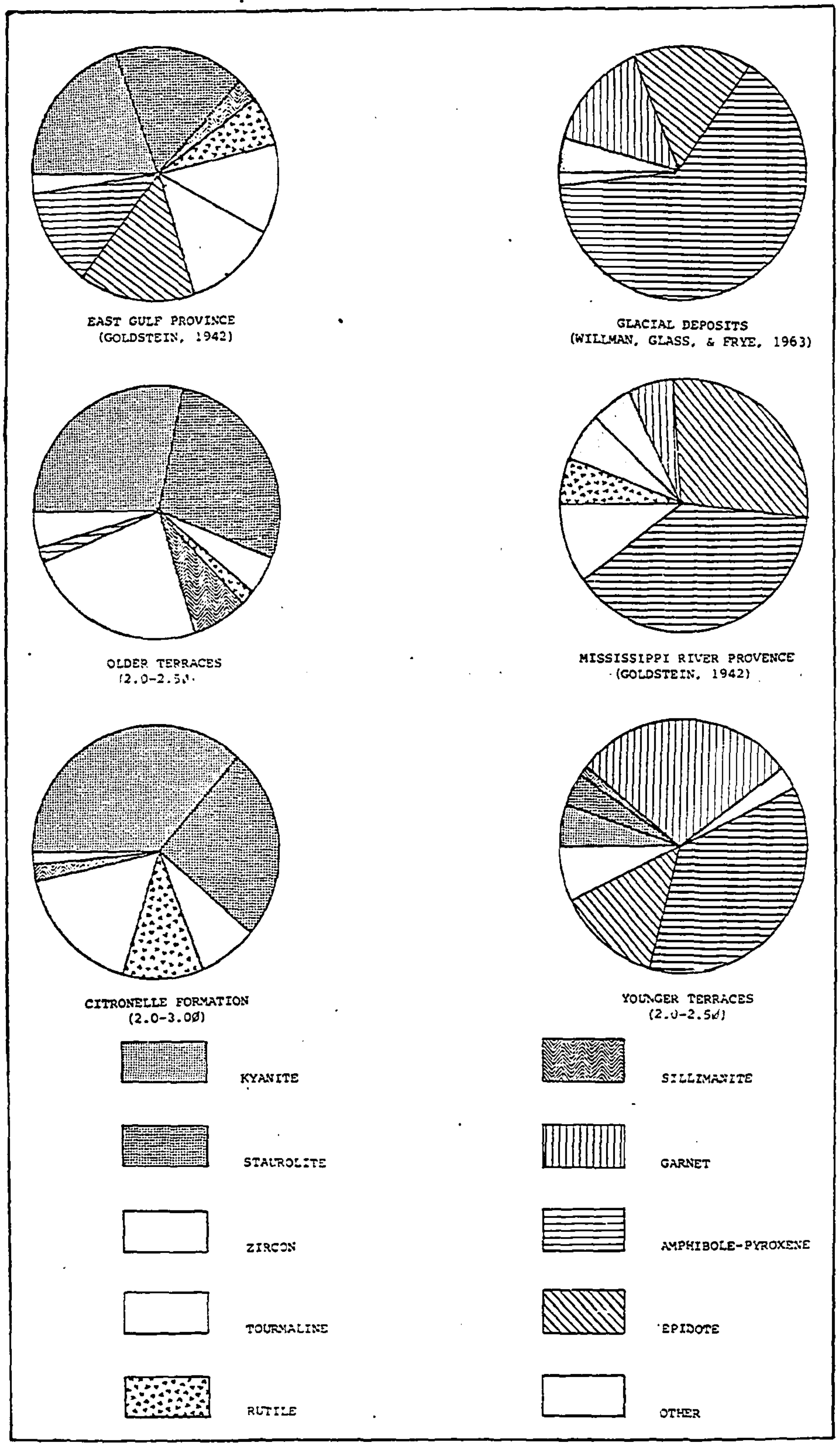

Figure 10: Citronelle and Louisiana terrace heavy mineral suites.

Louisiana, posessed little or no material in the 2.0-3.0ϕ range; the suite present, however, in the 3.0-4.0ϕ range is the same as is shown in the Prairie pie diagrams. The small amount of east Gulf Province heavy minerals present suggests reworking from nearby older deposits. Again, the lack of dolomite in these results is due to acidizing the samples. The other heavy minerals, however, are so diagnostic and different from the east Gulf Province suite and present in such large amounts, that there can be little doubt that the younger terrace deposits sampled contain the Mississippi River Province heavy mineral suite whereas the older terrace deposits do not.

Some questions, however, remain to be answered. Doering's Oberlin terrace in southwest Louisiana was not sampled as the terrace deposits in that region are very fine-grained so that no satisfactory samples for testing could be readily obtained. Doering's Eunice terrace deposits in southwest Louisiana also presented sampling problems as these sediments are generally silt or clay. A sample of the Eunice with some sand present was obtained at Bayou Grand Louis (see Fig. 3, Locality 222). The heavy minerals present in this sample indicate an east Gulf Province suite. From the sample's location, a possible eplanation would be that the material in this area is derived from the Red River as suggested by Fisk (1944). This sample, however, should not be judged as definitive for the entire Eunice. Detailed work in this area in connection with auger drilling is a necessity before satisfactory answers will be found.

A brief description of the important heavy minerals of this assemblage follows:

Augite: Augite occurs as green, rounded to angular prismatic grains, and, rarely, as irregular cleavage fragments. Most grains appear fresh.

Hornblende: Hornblende occurs as dark green, slightly pleochroic rounded to subangular prismatic grains. Most grains appear fresh.

Epidote: Epidote occurs as rounded to subrounded equidimensional grains. Epidote is characterized by its pistachio green color and a brilliant green-purple-red (ringed) interference tints observed in many grains (see Milner, 1962, p. 102).

Garnet: Garnet occurs as red to reddish orange, irregular, sometimes fractured, generally well-rounded grains which show no crystal faces. A colorless variety of garnet is present but not common.

Heavy Mineral Data Analysis

Introduction

The first purpose of this investigation was to determine whether the Mississippi River Province or the East Gulf Province heavy mineral suites are present in the Citronelle Formation and older terrace deposits of Louisiana, and if both suites are present, the relationship between the two suites by means of the ratio test discussed previously. As samples from these deposits were examined, it was soon evident that only one suite of heavy minerals, the East Gulf Province, was present in the Citronelle and older terraces. For this reason, the writer used the ratio test to determine whether important subsuites were present in these sediments.

The criteria for the minerals which are to be used in the numerical ratio test are: (1) they must have similar specific gravities, (2) they should be of similar shape, and (3) their physical and chemical stabilities should be somewhat similar. The minerals selected for this test were kyanite and staurolite. Kyanite has a specific gravity of 3.6-3.68, a hardness of 4 to 7, and occurs as prismatic (bladed) grains. Staurolite has a specific gravity of 3.65-3.75, a hardness of 7 to 7.5, and occurs as crudely prismatic grains. Both minerals are generally considered to be of similar chemical stability (e.g., Milner, 1962, p. 434).

The differential hardness of kyanite theoretically might cause a difference in grain-szie distributions. Todd and Folk (1957) described the heavy minerals of two Middle Eocene units in east Texas, the Newby sandstone and the Carrizo sandstone from which the Newby was derived. They noted that there was no apparent difference in the heavy mineral suite of the two formations; the kyanite percentage in both formations averaged 21 ± 1. The only difference in the kyanite grains of the two formations is that the Newby kyanite grains have rounded corners while the Carrizo kyanite grains have angular corners. It appears, therefore, that the differential hardness of kyanite is not a critical factor.

As kyanite and staurolite are most abundant in the 2.0-3.0Ø size range, the ratios were calculated for the 2.0-2.5Ø and the 2.5-3.0Ø size fractions. In the Citronelle samples, the heavy minerals of the two size fractions were separated from the replicate samples of each unit used in mechanical analysis; for the Louisiana terraces, the older terrace samples described in the previous section were used. Separatory procedures and slide preparation were done in the same manner as in the initial survey. The slides were point-counted and the first 300 nonopaque grains (not including mica) were classified as kyanite, staurolite, and others. The ratio kyanite/kyanite + staurolite (k/k+s) was then calculated. In all of the following ANOV tests, the inverse sine transformation was used on all data before ANOV calculations were preformed, in order to effect a more normal distribution (Steel and Torrie, 1960, p. 158). The procedures for calculating ANOV can be found in most statistical textbooks; however, a summary of the steps in calculating ANOV is given in Appendix VII.

Numerical Ratio Tests

Whether or not the two minerals can be considered hydraulically similar can be tested at outcrops with two or more units of different grain size distribution. If no significant difference can be found in the value of k/k+s between units of differing grain size distribution, then the two minerals can be considered hydraulically similar. Tables 3 and 4 summarize the results of these calculations based on 10 localities with two or more units in three states. The F-values are nonsignificant, indicating that the variation within units is greater than the variation between units. The ratio is assumed independent of unit grain size distribution and is assumed constant in each size split at any one locality.

The following questions need to be answered by ANOV calculations:

(1) In Alabama, Florida, and Mississippi, the spacing of samples is sufficiently broad so that subsuites may be present in each state.

LOC.	UNITS	SS_t	SS_b	MS_b	SS_w	MS_w	F	$*F_{0.05}$
115	5	227.38	185.69	46.42	48.63	9.72	5.00	5.19
75	3	10.22	00.46	00.23	9.76	3.25	0.07	9.55
38[a]	3	60.70	50.43	25.21	10.27	3.42	7.37	9.55
81	2	48.79	35.82	35.82	12.97	6.48	5.52	18.51
64	2	15.21	7.08	7.08	8.13	4.06	1.74	18.51
91	2	81.63	10.95	10.95	70.68	35.34	0.31	18.51
152[b]	2	32.16	0.25	0.25	31.91	15.95	0.02	18.51
151	2	12.23	00.00[c]	00.00[c]	12.23	6.12	1.00	18.51
68	2	15.60	00.00[c]	00.00[c]	15.60	7.80	1.00	18.51
78	2	27.90	5.43	5.43	22.47	11.23	0.48	18.51

a: replicate splits from one unit yielded 250 total grains each.

b: replicate splits from one unit yielded 77 and 71 grains each.

c: numerical value in third decimal.

Table 3: ANOV summary table for k/k+s for all localities with 2 or more units (2.0-2.5Ø). 300 counts per slide except where noted.

LOC.	UNITS	SS_t	SS_b	MS_b	SS_w	MS_w	F	$*F_{0.05}$
115	5	201.00	132.45	33.11	68.55	13.71	2.41	5.19
75	3	37.91	12.82	6.41	25.09	8.36	1.53	9.55
38	3	30.49	22.48	11.24	8.01	2.67	4.20	9.55
81	2	16.48	7.98	7.98	8.50	4.25	1.27	18.51
64	2	16.13	1.07	1.07	16.13	8.07	0.13	18.51
91	2	8.83	00.00[a]	00.00[a]	8.83	4.42	1.00	18.51
152	2	46.90	35.34	35.34	11.56	5.78	6.11	18.51
151	2	19.12	0.15	0.15	18.97	9.48	0.02	18.51
68	2	46.38	2.76	2.76	43.62	21.81	0.13	18.51
78	2	10.04	0.01	0.01	10.03	5.01	1.00	18.51

a: numerical value in third decimal.

Table 4:ANOV summary table for k/k+s for all localities with 2 or more units (2.5-3.0Ø). 300 counts per slide.

(2) A very close spacing of sample localities was used along the coastwise terrace belt of southwest Louisiana and along the fluviatile terraces of central Louisiana. Since the east Gulf Province assemblage indicates that these sediments were locally derived, it is apparent that the only difference in the ratio k/k+s that might be detected would be fluviatile deposition versus deltaic deposition.

(3) If there are no subsuite differences within states, is there a difference between states.

The data from Florida, Alabama, and Mississippi can be grouped into an hierarchical arrangement of localities within states. In addition, another question of academic interest, is there any difference between the two size splits, can be answered in the same calculation. The final arrangement of data would be localities within states within size splits. Table 5 is a summary of the results of these calculations. In the 2.0-2.5$\emptyset$ size class, 118 observations are from 59 units in 44 localities in three states. In the 2.5-3.0$\emptyset$ class, 120 observations are from 60 units in 45 localities in three states. The data indicate that in this tri-state area, there is no variation in the heavy mineral suite in the Citronelle Formation except for differences accountable to grain size variation.

SOURCE	df	SS	MS	F	$^{*}F_{0.05}$
Total	237	5350.45	------	------	------
Size Splits	1	119.87	119.87	5.68	3.90
States	2	16.08	8.04	0.38	3.06
Localities	85	2068.50	24.33	1.15	1.37
Units (error)	149	3146.00	21.11	------	------

Table 5: Summary ANOV table for k/k+s for localities within states within size splits.

Table 6 is an ANOV summary table of a test for significant differences in the ratio k/k+s in the 2.0-2.5∅ size class between the fluviatile terraces and coastwise terraces of western Louisiana, using 7 samples from the fluviatile deposits and 6 samples from the deltaic plain deposits. The results indicate no significant difference in the ratio k/k+s between these two areas. This could mean either the ratio is independent of the nature of the depositional environment or that the coastwise terraces are in fact fluviatile in origin. As Doering (1956) has mapped the coastwise formations as Citronelle and Lissie, both statements may be correct.

If these samples are uniform, are they different from the Citronelle samples east of the Mississippi River? The results of this ANOV calculation for the 2.0-2.5∅ size class are summarized in Table 7. This calculation was based on 15 observations from 15 localities in Louisiana (from the Williana, Bentley, and Montgomery of Fisk and the Citronelle and Lissie of Doering) and 118 observations from 59 units in 44 localities in Mississippi, Alabama, and Florida. The results of this calculation indicate that a subsuite difference is present between the deposits on either side of the Mississippi River Valley.

Table 8 is a summary of the mean ($\bar{x}$), the confidence interval about the mean (±L), and the standard deviation (s) for the calculated ratios.

SOURCE	df	SS	MS	F	$^{*}F_{0.05}$
Total	14	497.95	-----	-----	-----
Between Areas	1	71.08	71.08	2.16	4.67
Localities (error)	13	426.87	32.84	-----	-----

Table 6: Summary ANOV table for fluviatile vs coastwise terrace (area) deposits (2.0-2.5ϕ).

SOURCE	df	SS	MS	F	*$F_{0.05}$
Total	132	586.04	-----	-----	-----
Between states	1	68.09	68.09	17.24	3.84
Localities (error)	131	517.95	3.95	-----	-----

Table 7: Summary ANOV table for Louisiana vs Mississippi, Alabama, and Florida (2.0-2.5Ø).

	$\bar{X}$	$\pm L$	s
Fla.-Ala. 2.0-2.5Ø	55.85	1.13	5.19
Mississippi 2.0-2.5Ø	55.61	3.73	10.50
All samples 2.0-2.5Ø	54.92	1.29	7.08
Fla.-Ala. 2.5-3.0Ø	53.17	1.17	5.46
Mississippi 2.5-3.0Ø	51.53	2.69	7.72
All samples 2.5-3.0Ø	52.70	1.11	6.15
Louisiana	51.80	5.87	11.03

Table 8: Mean, confidence limits, and standard deviation of ratio k/k+s.

INTERPRETATION

Interpretation of the data presented by this report and from previous work indicates that three types of deposits have been examined: (1) the Citronelle Formation, containing an East Gulf Province heavy mineral assemblage; (2) an older terrace deposit also containing an East Gulf Coast Province heavy mineral assemblage; and (3) Mississippi River terrace deposits which possess a Mississippi River Province heavy mineral assemblage.

It is evident that the hypothesis advanced by Doering (1956, 1958) and Clendenin (1896), that the Citronelle represents deposits of preglacial, coalescing, braiding streams in response to epeirogenic uplift of the continental interior, best explains the known facts about the Citronelle.

If Fisk's theory of the origin of these deposits were correct, (1) the material eroded during the glacial stage entrenchment would not have been deposited in the valleys but would have been flushed out to sea, and (2) the material which forms the terrace deposits along the Mississippi River would have to have been derived from glacial outwash. Fisk (1951, p. 341) implied this fact in stating,

> "All the terraces can be traced directly up the Upper Mississippi and Ohio River Valleys, thus proving that the sediments of all the terrace formations came from the same general source area."

From the data presented, this is clearly not true.

If Doering's Eunice and Oberlin terraces in southwest Louisiana are Mississippi and Red river deposits, the question remains as to what the Lissie fluviatile deposits in Grant and LaSalle parishes (the type area for Fisk's Williana, Bentley, and Montgomery) represent as these sediments possess an eastern Gulf Province heavy mineral suite, and the sediments are over one hundred feet lower than the Citronelle (see Figure 2 of Doering, 1956, p. 1826-1827).

Although Fisk (1939b) rejected lateral planation as an hypothesis for the origin of the fluviatile terraces, Durham (1961) suggested that scour and fill associated with lateral planation during glacial stages can account for the formation of the entrenched valley and thick alluvial valley fill simultaeously. The box-shaped cross section, truncation of spurs, and indentation of the valley walls by arcuate meander scars support this theory.

If Durham is correct, then deposits which resemble the Citronelle Formation could be formed by the Mississippi and Red rivers at lower than expected elevations whenever the river encised against the Citronelle sediments; thus, this could account for the Lissie fluviatile deposits. The lack of glacial heavy minerals in these deposits might be explained in one of three ways: (1) these deposits representing a Pliocene period of entrenchment; (2) the deposits which have been preserved are Kansan in age so that no glacial deposits had yet been eroded, or (3) terraces of at least two glacial cycles are present but glacially derived heavy minerals did not arrive until, perhaps, as late as Irene time.

The younger terrace deposits appear to be related to fluctuating sea level during Pleistocene glaciation. Their relationship to the modern Mississippi River deposits is well illustrated by (1) their common heavy mineral assemblage, and (2) the presence of Mississippi River meander scars on the surface of the terrace deposits. More thorough work is needed to determine the relationship between Doering's Eunice, Oberlin, and Holloway Prairie in western Louisiana and the Port Hickey and Irene terraces of Durham, Moore, and Parsons in eastern Louisiana.

CONCLUSIONS

The most probable explanation for the Citronelle Formation is that these deposits represent an alluvial apron formed by braiding, coalescing streams as postulated by Clendenin (1890), Doering (1956), and Parsons (1967). Eperiogenic uplift of the continental interior as envisioned by Clendenin (1896), Doering (1958), and perhaps Matson (1916), caused a time of increased stream activity and erosion and deposition in the entire Gulf Coast region. The uplift resulted in the erosion of Cretaceous deposits which, as evidenced by outliers of Cretaceous deposits in the southern Appalachians, once extended farther north than at present; very likely, the Tertiary sands also extended farther north and served as a source for some of the material in the Citronelle east of the Mississippi Valley and probably all of the Citronelle west of the Mississippi Valley.

After deposition of the Citronelle, progressive encisement by the Mississippi River and other streams, associated with uplift and tilting along the northern flank of the Gulf Coast geosyncline, formed entrenched valleys containing fluviatile terraces. Deltaic plains, equivalent to these fluviatile deposits, were similarly uplifted and tilted to form coastwise terraces. In some areas, associated faults have been misinterpreted as terrace scarps.

The oldest of the fluviatile terraces are identical lithologically and mineralogically with the Citronelle Formation. The Mississippi River Province heavy minerals suite has been recognized in younger terrace deposits: the Holloway Prairie, the Port Hickey, and the Irene. These deposits are believed to be related to fluctuating sea level associated with Pleistocene glaciation. Additional field work is needed, however, before this can be proven positively true.

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APPENDIX I

Location of Localities

Localities from which samples were collected are listed. Each locality was assigned a number; some closely spaced localities, however, were given the same number and a different letter (A, B, C). Samples studied in the laboratory are indicated. When more than one sample was taken from the same locality, a letter was given to each sample, with A being the lowest unit exposed. Localities which were visited and assigned a number but from which no samples were collected are not listed.

The following data are given: (1) nature of exposure, (2) distance to a point of reference, (3) township and range, (4) and map name (U. S. Geologic Survey, 1:250,000 series).

Locality 5: Gravel pit, east side, and road cuts, west side, along Laneheart Road, 1.4 mi. north of jct. with Miss. Hwy. 24, T2N, R2W, Natchez; sample studied: 5-F.

Locality 7: Road cut, south side, along Miss. Hwy. 24, 9.3 mi. west of jct. with Miss. Hwy. 33, T1N, R1E, Natchez.

Locality 9: Road cut, north side, and gravel pit, south side, along Miss. Hwy. 24, 6.1 mi. east of jct. with Miss. Hwy. 33, T3N, R3E, Natchez.

Locality 12: Road cut, north side, along Miss. Hwy. 24, 9.3 mi. east of jct. with Miss. Hwy. 33, T2N, R4E, Natchez. One sample collected and studied.

Locality 13: Road cut, north side, along Miss. Hwy. 24, about 0.1 mi. east of the Amite River, T2N, R4E, Natchez. Fairly good exposure.

Locality 14: Road cut, north side, along Miss. Hwy. 24, about 0.75 mi. east of Locality 13, 0.85 mi. east of the Amite River, T2N, R4E, Natchez.

Locality 16: Road cut, south side, along Miss. Hwy. 24, 11 mi. west of jct. with Miss. Hwy. 48, T3N, R5E, Natchez.

Locality 18: Gravel pit, south side, along Miss. Hwy. 24, 0.5 mi. west of jct. with Miss. Hwy. 48, T3N, R7E, Natchez; samples studied: 18-B, 18-D. Good exposure.

Locality 20: Road cut, east side, along Percy Quinn State Park Road at south entrance to park, T3N, R7E, Natchez. Good exposure.

Locality 22: Second gravel pit on south side of U. S. Hwy. 98, about 2.5 mi. east of McComb, Miss., T3N, R9E, Natchez. Good exposure.

Locality 23: Gravel pit, south side, along U. S. Hwy. 98, 2.0 mi. east of Pike-Walthall counties border, T3N, R9E, Natchez.

Locality 28: Road cut, west side, along Miss. Hwy. 13, 14.2 mi. south of jct. with U. S. Hwy. 84, T6N, R13E, Hattiesburg.

Locality 28C: Road cut, west side, along Miss. Hwy. 13, 9.2 mi. south of jct. with U. S. Hwy. 84, T6N, R19W, Hattiesburg.

Locality 28D: Road cut, west side, along Miss. Hwy. 13, 2.6 mi. south of jct. with U. S. Hwy. 84, T7N, R19W, Hattiesburg. Good exposure.

Locality 30: Road cut, east side, along Miss. Hwy. 13, 3.8 mi. north of jct. with U. S. Hwy. 84, T8N, R19W, Hattiesburg.

Locality 31: Road cut, east side, along Miss. Hwy. 13, 7.4 mi. north of jct. with U. S. Hwy. 84, T8N, R19W, Hattiesburg.

Locality 32: Road cut, west side, along Miss. Hwy. 13, 3.8 mi. south of Jefferson Davis-Simpson counties border, T8N, R19W, Hattiesburg.

Locality 34: Road cut, west side, along Miss. Hwy. 13, 4.3 mi. north of Jefferson Davis-Simpson counties border, T10N, R19W, Hattiesburg. One sample collected and studied.

Locality 36: Road cut, east side, along U. S. Hwy. 49, 5.9 mi. south of jct. with Miss. Hwy. 13, T1N, R5E (Choctaw Base Line and Meridian), Hattiesburg. One sample collected and studied.

Locality 38: Road cut, west side, along U. S. Hwy. 11, 2.1 mi. north of railroad overpass north of Lumberton, Miss., T1N, R14W, Hattiesburg; samples studied: 38-A, 38-B, 38-C. Good exposure.

Locality 39: Road cut, west side, along U. S. Hwy. 11, 6.2 mi. north of Lamar-Pearl River counties border, T1S, R15W, Mobile. Similar to Locality 38; good exposure.

Locality 40: Road cut, west side, along U. S. Hwy. 11, 12.6 mi. south of Lamar-Pearl River counties border, T2S, R16W, Mobile.

Locality 41: Road cut, south side, along unnamed dirt road directly north of Lee Lake, T6S, R15W, Mobile.

Locality 41A: Road cut, south side, along Miss. Hwy. 53, 1.3 mi. south of jct. with Miss. Hwy. 603, T6S, R14W, Mobile.

Locality 41B: Road cut, south side, along Miss. Hwy. 53, 6.7 mi. south of jct. with Miss. Hwy. 603, T6S, R19E, Mobile.

Locality 42: Road cut, east side, along U. S. Hwy. 49, 5.5 mi. north of jct. with U. S. Hwy. 90, T7S, R11W, Mobile.

Locality 43: Road cut, east side, along U. S. Hwy. 49, 0.9 mi. north of southern boundary of De Soto National Forest, T6S, R11W, Mobile.

Locality 45: Road cut, east side, along U. S. Hwy. 49, 6.6 mi. north of southern boundary of De Soto National Forest, T5S, R11W, Mobile.

Locality 47: Road cut, east side, along U. S. Hwy. 49, 1.8 mi. north of jct. with Miss. Hwy. 67, T4S, R11W, Mobile. One sample collected and studied.

Locality 50: Road cut, west side, along Mobile County Road 5, 1.4 mi. south of jct. with U. S. Hwy. 98, T3S, R4W, Mobile. One sample collected and studied.

Locality 54: Road cut, west side, along Mobile County Road 5, about 3.0 mi. north of jct. with U. S. Hwy. 90, T6N, R4W, Mobile. One sample collected and studied.

Locality 55: Railroad embankment, south side, along U. S. Hwy. 90, about 3.0 mi. east of Grand Bay, Ala., T6S, R3W, Mobile. One sample collected and studied.

Locality 60: Road cut, east side along U. S. Hwy. 45 at jct. with Ala. Hwy. 24, in Citronelle, Ala. One sample collected and studied; good exposure.

Locality 61: Road cut, east side, along Center Road, 4.9 mi. south of Citronelle railroad station, T1N, R2W, Hattiesburg. One sample collected and studied.

Locality 62: Gravel pit, south side, along Mobile County Road 43/96 (Mt. Vernon Road), 6.2 mi. north (east) of Citronelle railroad station. Good exposure.

Locality 63: Gravel pit, north side, along Mt. Vernon Road, 10.4 mi. north (east) of Citronelle railroad station, T2N, R2W, Hattiesburg. One sample collected and studied.

Locality 64: Road cut, south side, along Mt. Vernon Road, 16.6 mi. north (east) of Citronelle railroad station, T2N, R1W, Hattiesburg. One sample collected and studied. See also road cut (south side) 0.9 mi. to the east; one sample collected and studied (64A).

Locality 68: Road cut, west side, along U. S. Hwys. 43-84, 36.3 mi. north of jct. with Mt. Vernon Road, T6N, R2E, Andalusia. One sample collected and studied. See also road cut 0.3 mi. to the north; one sample collected and studied (68A).

Locality 73: Road cut, east side, along U. S. Hwys. 43-84, at northern city limits of Jackson, Ala., T7N, R2E, Andalusia. One sample collected and studied; good exposure.

Locality 74: Road cut, west side, along U. S. Hwys. 43-84, 3.6 mi. north of Jackson, Ala. northern city limits, T7N, R2E, Andalusia. One sample collected and studied.

Locality 75: Road cut, north side, along U. S. Hwy. 84, east of Grove Hill, Ala., 1.5 mi. west of Whatley, Ala., T8N, R2E, Andalusia. Samples studied: 75-A, 75-B, 75-D.

Locality 77: Road cut, north side, along U. S. Hwy. 84, 3.1 mi. east of Whatley, Ala., T8N, R4E, Andalusia. One sample collected and studied.

Locality 78: road cut, south side, along U. S. Hwy. 84, 8.1 mi. east of Whatley, Ala., T7N, R5E, Andalusia. Sample studied: 78-B. Also see road cut 0.2 mi. to the east; one sample collected and studied (78A).

Locality 79: Road cut, north side, along U. S. Hwy. 84, at jct. with Monroe County Road 23, T6N, R6E, Andalusia. One sample collected and studied.

Locality 80: Gravel pit; west side, along Ala. Hwy. 21, 0.6 mi. south of Monroe-Escambia counties border, T6N, R6E, Andalusia. One sample collected and studied.

Locality 81: Gravel pit, east side, along Ala. Hwy. 21, 9.4 mi. south of Monroe-Escambia counties border, T2N, R6E, Andalusia. Samples studied: 81-A, 81-B.

Locality 82A: Road cut, north side, along U. S. Hwy. 31, by Bushy Creek bridge, west of Atmore, Ala., T1N, R5W, Andalusia. One sample collected and studied.

Locality 83: Road cut, south side, along U. S. Hwy. 31, at power substation (south side), about 5 mi. west of Locality 82A, T1S, R34W, Pensacola.

Locality 84: Road cut, south side, along U. S. Hwy. 31, 7.1 mi. south of Locality 83, T1S, R3W, Pensacola. One sample collected and studied. Fairly good exposure.

Locality 86: Road cut, south side, along U. S. Hwy. 90, 2.0 mi. east of jct. with U. S. Hwy. 98, T7S, R4E, Pensacola. One sample collected and studied.

Locality 87: Exposure along east side of road on Alabama side of Perdido Bay,1.85 mi. south of Lillian, Ala., T8S, R6W, Pensacola. One sample collected and studied.

Locality 88: Gravel pit 0. 8 mi. south on dirt road, from intersection with U. S. Hwy. 90, 0.9 mi. east of Perdido Beach Road, 2.6 mi. west of Lillian, Alabama, T8S, R6W., Pensacola. One sample collected and studied.

Locality 89: Exposure along beach cliff, south side of U. S. Hwy. 90, along Escambia Bay, 4.4 mi. east of jct. with U. S. Hwy. 98, T1S, R29W, Pensacola. One sample collected and studied. Good exposure.

Locality 90A: Railroad embankment, east side, at U. S. Hwy. 90 overpass, west of Crestview, Fla., T3N, R24W, Pensacola. One sample collected and studied.

Locality 91: Gravel pit, south side, along Fla. Hwy. 4, in Black Water River State Forest, 20.3 mi. west of jct. with U. S. Hwy. 90. Samples studied: gravelly unit= 91-A, gritty unit= 91-B. Best exposure in Florida Panhandle.

Locality 92B: Road cut, west side, along U. S. Hwy. 29, 1.7 mi. south of jct. with Fla. Hwy. 4, T4N, R31W, Pensacola. One sample collected and studied.

Locality 93A: Road cut, west side, along U. S. Hwy. 29, 6.2 mi. south of jct. with Fla. Hwy. 4, T4N, R31W, Pensacola. One sample studied and collected.

Locality 94: Road cut, west side, along U. S. Hwy. 29, 11.6 mi. south of jct. with Fla. Hwy. 4, T3N, R31W, Pensacola. One sample collected and studied.

Locality 95A: Gravel pit, east side, along U. S. Hwy. 51, 12.2 mi. south of jct. with U. S. Hwy. 84, T5N, R7E, Natchez. One sample collected and studied.

Locality 95B: Road cut, east side, along U. S. Hwy. 51, 11.8 mi. south of jct. with U. S. Hwy. 84, T5N, R7E, Natchez.

Locality 95C: Road cut, west side, along U. S. Hwy. 51, 12.0 mi. south of jct. with U. S. Hwy. 84, T5N, R7E, Natchez.

Locality 96A: Road cut, east side, along U. S. Hwy. 51, 3.9 mi. south of jct. with Miss. Hwy. 28, T10N, R8E, Natchez.

Locality 96B: Road cut, east side, along U. S. Hwy. 51, 2.1 mi. south of jct. with Miss. Hwy. 28, T10N, R8E, Natchez.

Locality 96C: Road cut, west side, along U. S. Hwy. 51, 8.75 mi. south of jct. with Miss. Hwy. 28, T9N, R8E, Natchez.

Locality 97B: Road cut, east side, along U. S. Hwy. 51, 8.4 mi. north of jct. with Miss. Hwy. 28-West, T2N, R2W (Choctaw Base Line and Meridian), Natchez.

Locality 100: Road cut and gravel pit, south side, along U. S. Hwy. 98, about 5 mi. west of jct. with U. S. Hwy. 49, T4N, R14W, Hattiesburg. One sample collected and studied.

Locality 101: Road cut, north side of U. S. Hwy. 98, 0.8 mi. east of jct. with Miss. Hwy. 589, T4N, R14W, Hattiesburg. One sample collected and studied.

Locality 102: Road cut, south side, along U. S. Hwy. 98, 0.8 mi. west of jct. with Miss. Hwy. 589, T4N, R14W, Hattiesburg.

Locality 103: Road cut, north side of U. S. Hwy. 98, 7.5 mi. west of jct. with Miss. Hwy. 589, T4N, R15W, Hattiesburg.

Locality 104: Road cut on U. S. Hwy. 98 and intersection with dirt road 16. 3 mi. west of jct. with Miss. Hwy. 589, SW corner of intersection; T4N, R17W, Hattiesburg.

Locality 105: Road cut, north side of U. S. Hwy. 98, 20.1 mi. west of jct. with Miss. Hwy. 589, T4N, R17W, Hattiesburg. Good exposure.

Locality 107: Road cut, north side, along U. S. Hwy. 98, 7.0 mi. east of jct. with Miss. Hwy. 48 at Tylertown, Miss., T2N, R11E, Natchez.

Locality 108: Road cut, north side of U. S. Hwy. 98, 14 mi. east of jct. with Miss. Hwy. 48 east of Tylertown, T3N, R12E, Hattiesburg.

Locality 109: Road cut, north side of U. S. Hwy. 98, 21 mi. east of jct. with Miss. Hwy. 48, east of Tylertown, T3N, R13E, Hattiesburg. Sample studied: 109-B.

Locality 110: Road cut, east side of Miss. Hwy. 48, about 0.5 mi. south of Liberty, Miss., T2N, R4E, Natchez.

Locality 111: Road cut, east side of Miss. Hwy. 48, about 2.6 mi. south of Liberty, Miss., T2N, R4E, Natchez.

Locality 113: Road cut, west side of Miss. Hwy. 569, about 1.9 mi. south of jct. with Miss. Hwy. 48, T2N, R3E, Natchez.

Locality 114: Road cut, south side of Miss. Hwy. 48, 6.9 mi. west of jct. with Miss. Hwy. 48, T2N, R2E, Natchez.

Locality 115: Road cut, west side of Miss. Hwy. 33, 3.5 mi. north of Gloster, Miss., T3N, R2E, Natchez. Samples studied: 115-A, 115-B, 115-C, 115-F, 115-G.

Locality 116: Road cut at jct. of Miss. Hwy. 33 and U. S. Hwys. 84-98, NE corner of intersection; T6N, R1E, Natchez.

Locality 117: Gravel pit, east side of U. S. Hwy. 51, about 4.6 mi. north of jct. with Miss. Hwy. 584, T1N, R7E, Natchez. One sample collected and studied.

Locality 118: Road cut, north side of Miss. Hwy. 584, about 1.0 mi. west of jct. with U. S. Hwy. 51, T1N, R7E, Natchez.

Locality 119: Road cut, north side of Miss. Hwy. 584, about 3.0 mi. west of jct. with U. S. Hwy.51, T1N, R7E, Natchez.

Locality 121: Road cut, south side of Miss. Hwy. 584, 5.2 mi. west of Amite-Pike counties border, T1N, R6E, Natchez.

Locality 125: Road cut, west side of U. S. Hwy. 61, about 1.5-2.0 mi. south of Port Gibson, Miss. (Citronelle under loess), T1N, R2E (Choctaw Base line and Meridian), Natchez. Only exposure on west side of road in this area.

Locality 126: Road cut, south side of Miss. Hwy. 20, about 8.3 mi. east of Fayette, Miss., T8N, R3E, Natchez. One sample collected and studied.

Locality 127: Road cut, south side of Union Church-Caseyville Road, 17.5 mi. east of Fayette, Miss., T8N, R4E, Natchez.

Locality 128: Road cut, north side of Union Church-Caseyville Road, about 4.8 mi. east of Jefferson-Lincoln counties border, T8N, R5E, Natchez.

Locality 129: Road cut, east side of U. S. Hwy. 49, 7.4 mi. north of jct. with Miss. Hwy. 67, T3S, R11W, Mobile.

Locality 130: Road cut, east side of U. S. Hwy. 49, 5 mi. north of jct. with Miss. Hwy. 67, T3S, R11W, Mobile.

Locality 131: Road cut, west side of U. S. Hwy. 49, 3.5 mi. north of Covington-Forrest counties border, T6N, R15W, Hattiesburg.

Locality 135: Gravel pit, west side of Miss. Hwy. 13, 20.4 mi. south of jct. with U. S. Hwy. 84, T4N, R14E, Hattiesburg.

Locality 136: Road cut, west side of U. S. Hwy. 11, 5.1 mi. south of jct. with U. S. Hwy. 49, T3N, R14W, Hattiesburg.

Locality 137: Gravel pit, west side of U. S. Hwy. 11, 12.5 mi. south of jct. with U. S. Hwy. 49, T2N, R14W, Hattiesburg.

Locality 138: Gravel pit, dirt road on south side of Miss. Hwy. 26, between Poplarville, Miss., and Wolf Creek, T2S, R15W, Mobile. Good exposure; one sample collected and studied.

Locality 139: Road cut, north side of Miss. Hwy. 26, about 4.0 mi. east of Pearl River-Stone counties border, T2S, R19E, Mobile.

Locality 140: Road cut, north side of Miss. Hwy. 26, 2.0 mi. west of Pearl River-Stone counties border, T2S, R18E, Mobile. One sample colllected and studied.

Locality 141: Road cut, north side of Miss. Hwy. 26, 7.0 mi. west of Pearl River-Stone counties border, T2S, R18E, Mobile.

Locality 142: Road cut, south side of Miss. Hwy. 67, 3.1 mi. south of jct. with U. S. Hwy. 49, T4S, R14W, Mobile.

Locality 143: Road cut, east side of Miss. Hwy. 57, 14 mi. south of jct. with Miss. Hwy. 26, T4S, R8W, Mobile. One sample collected and studied.

Locality 146: Road cut, east side of Miss. Hwy. 63, 6.1 mi. north of George-Jackson counties border, T3S, R6W, Mobile. One sample collected and studied.

Locality 149: Road cut, north side of U. S. Hwy. 98, 6.0 mi. east of jct. with Miss. Hwy. 63, T1S, R5W, Mobile.

Locality 150: Gravel pit, west side of U. S. Hwy. 45, 6.8 mi. north of Lott Road intersection, T2S, R2W, Mobile. One sample collected and studied.

Locality 151: Road cut, west side of U. S. Hwy. 45, 11.3 mi. north of Lott Road intersection, T2S, R2W, Mobile. Samples studied: 151-A, 151-B (basal sand).

Locality 152: Road cut, west side of U. S. Hwy. 45, 19.9 mi. north of Lott Road intersection, T1N, R3W, Hattiesburg. Samples studied: 152-B, 152-D.

Locality 153: Road cut, east side, along U. S. Hwy. 43, 24.9 mi. north of jct. with Mt. Vernon Road (see Locality 64), T5N, R1W, Hattiesburg. One sample collected and studied.

Locality 154: Gravel pit, west side of U. S. Hwy. 43, 29.4 mi. north of jct. with Mt. Vernon Road, T6N, R1E, Andalusia. One sample collected and studied.

Locality 155: Road cut, south side of U. S. Hwy. 31, at west end of Mobile, Ala., Causeway (at jct. with U. S. Hwys. 90-98), T4S, R2E, Pensacola.

Locality 156: Road cut, south side of U. S. Hwy. 90, 2.0 mi. east of jct. with U. S. Hwy. 98, T4S, R2E, Pensacola. One sample collected and studied.

Locality 157: Road cut, west side of U. S. Hwy. 90, 0.6 mi. south of eastern jct. with U. S. Hwy. 90-A, T2S, R29W, Pensacola. One sample collected and studied.

Louisiana Localities: The following localities are described as: (1) nature of exposure, (2) section, township, and range number, (3) name of 15 minute quadrangle, (4) and if location is uncertain, distance to point of reference.

Locality 200: Gravel pit, SE$\frac{1}{4}$, SE$\frac{1}{4}$, Sec. 14, T10N, R7E, Sicily Island Quadrangle; mapped as Bentley. One sample collected and studied.

Locality 201: Gravel pit, NW$\frac{1}{4}$, SW$\frac{1}{4}$, Sec. 4, T10N, R7E, Harrisonburg Quadrangle; mapped as Bentley. One sample collected and studied.

Locality 202: Road cut, east side, SE$\frac{1}{4}$, Sec. 2, T10N, R5E, Harrisonburg Quadrangle. About 0.2-0.3 mi. south of Catahoula Church; mapped as Plio-Pleistocene by Levert (1959). One sample collected and studied.

Locality 203: Gravel pit by Manifest, La., SE$\frac{1}{4}$, Sec. 33, T9N, R5E, Jonesville Quadrangle; mapped as Bentley. One sample collected and studied.

Locality 204: Road cut, east side, Sec. 39, T8N, R4E, Jena Quadrangle, 0.5 mi. west of Rhineheart, La., along dirt road; mapped as Montgomery. One sample collected and studied.

Locality 205: Road cut, west side of La. Hwy. 127, SE$\frac{1}{4}$, NE$\frac{1}{4}$, Sec. 3, T7N, R3E, Jena Quadrangle, 1.7 mi. north of Nebo, La.; mapped as Williana. One sample collected and studied.

Locality 209: Auger hole by R. Dobbins, north side of La. Hwy. 963, Sec. 74, T3S, R2W, New Roads Quadrangle (Port Hudson 7$\frac{1}{2}$ minute quadrangle is a better map of area); 0.5 mi. east of jct. with U. S. Hwy. 61; samples of the Citronelle from depths of 137 feet, 115 feet, and 92 feet were studied.

Locality 210: Samples of the Bentley Formation collected by B. E. Parsons across from Oak Grove Church on La. Hwy. 19 in Grant Parish, La.; one sample studied.

Locality 222: Road cut, north side of La. Hwy. 167, Sec. 64, T4S, R3E, Opelousus Quadrangle, at Bayou Grand Louis; mapped as Prairie (Oberlin); one sample studied.

Locality 224: Road cut, NW corner of intersection on La. Hwy. 112, Sec. 16, T1N, R1W, Lecompte Quadrangle, west of Midway, La.; mapped as Bentley, one sample studied.

Locality 225: Road cut, west side of U. S. Hwy. 165, NW$\frac{1}{4}$, NW$\frac{1}{4}$, Sec. 6, T1N, R1W, Forest Hill Quadrangle, 3.7 mi. south of Woodworth, La.; mapped as Bentley, one sample collected and studied.

Locality 226: Road cut, NE corner of road intersection on La. Hwy. 113, NE$\frac{1}{4}$, NW$\frac{1}{4}$, Sec. 12, T1S, R4W, Oakdale Quadrangle, 1.8 mi. east of jct. with La. Hwy. 113; mapped as Montgomery, one sample collected and studied.

Locality 227: Road cut, north side of La. Hwy. 113, NE$\frac{1}{4}$, NE$\frac{1}{4}$, Sec. 11, T1S, R4W, Oakdale Quadrangle, 5.0 mi. east of Vernon-Rapides parishes border, one sample studied.

Locality 228: Road cut, south side of La. Hwy. 113, 3.2 mi. east of jct. with La. Hwy. 10, NW$\frac{1}{4}$, SW$\frac{1}{4}$, Sec. 26, T1S, R5W, Elizabeth Quadrangle; by Montgomery-Bentley border, could be either. One sample studied.

Locality 229: Road cut, east side of La. Hwy. 463, SE$\frac{1}{4}$, SE$\frac{1}{4}$, Sec. 32, T1N, R6W, Leander Quadrangle, 0.2 mi. north of Big Brushy Creek bridge; mapped as Williana, one sample collected and studied.

Locality 230: Road cut, south side of La. Hwy. 10, SW$\frac{1}{4}$, NW$\frac{1}{4}$, Sec. 24, T1S, R7W, Sugartown Quadrangle, west of Cravens, La.; Montgomery, near the Williana-Montgomery boundary. One sample collected and studied.

Locality 231: Abandoned gravel pit now a garbage dump, SW$\frac{1}{4}$, SW$\frac{1}{4}$, Sec. 15, T1S, R9W, De Ridder Quadrangle, mapped as Williana; one sample collected and studied.

Locality 232: Road cut, north side of dirt road, SW¼ SE¼, NE¼, Sec. 25, T1S, R10W, De Ridder Quadrangle, 1.0 mi. east of Bayou Anacoco gauging station; mapped as Bentley, one sample collected and studied.

Locality 233: Road cut, east side of La. Hwy. 464, SW¼, SW¼, SW¼, Sec. 28, T1N, R10W, Leesville Quadrangle, 1.1 mi. north of road intersection in Sec. 32, T1N, R10W; mapped as Williana, one sample collected and studied.

Locality 234: Road cut, east side of La. Hwy. 464, SE¼, SE¼, SE¼, Sec. 9, T1N, R10W, Leesville Quadrangle, 3.3 mi. south of jct. with La. Hwy. 8; one sample studied.

Locality 235: Road cut, south side of La. Hwy. 8, SE¼, NE¼, Sec. 31, T2N, R10W, Leesville Quadrangle, 2.3 mi. west of jct. with La. Hwy. 464, mapped as Bentley; one sample collected and studied.

Locality 236: Road cut, east side of Hornbeck Road, center of NW¼, Sec. 10, T4N, R9W, Florien Quadrangle, mapped as Williana; one sample studied.

Locality 237: Road cut, northeast side of Toro-Plainview Road; NE¼, NE¼, Sec. 21, T5N, R10W, Florien Quadrangle, about 1.0 mi. north of Plainview School; Plio-Pliestocene of Levert (1959).

Locality 238: Road cut, northeast side of Toro-Plainview Road, SW$\frac{1}{4}$, NW$\frac{1}{4}$, Sec. 22, T5N, R10W, Florien Quadrangle, 0.6 mi. north of Plainview school; Plio-Pleistocene of Levert (1959), one sample collected and studied.

Locality 239: Road cut, northeast side, Toro-Plainview Road, SW$\frac{1}{4}$, NW$\frac{1}{4}$, Sec. 22, T5N, R10W, Florien Quadrangle, 0.5 mi. north of Plainview school; Plio-Pleistocene of Levert (1959), one sample collected and studied.

Locality 240: Road cut, east side of Hornbeck Road, Sec. 15, T4N, R10W, Florien Quadrangle, 2.9 mi. south of Plainview school; mapped as Williana, one sample studied.

Locality 241: Road cut, west side of La. Hwy. 111; SW$\frac{1}{4}$, Sec. 20, T2N, R11W, Wiergate Quadrangle; mapped as Montgomery, one sample taken and studied.

Locality 243: Road cut, east side of La. Hwy. 111, about 2.0 mi. north of Bivens, La., SW$\frac{1}{4}$, NE$\frac{1}{4}$, Sec. 4, T5S, R12W, Bon Wier Quadrangle; mapped as Bentley, one sample collected and studied.

Locality 244: Road cut, east side of La. Hwy. 110, 4.7 mi. east of Singer, La., along boundary of Secs. 22-23, T5S, R10W, Singer Quadrangle; mapped as Bentley, one sample collected and studied.

Locality 245: Base of bluffs by oil storage tanks on north side of La. Hwy. 10, east boundary of Sec. 43, T33S, R3W, St. Francisville Quadrangle; 0.1 mi. east of railroad tracks; mapped as Port Hickey, one sample studied.

Localities 246-247: Gravel pit along edge of Prairie Terrace, north side of Lake Pearl, Sec. 21, T1N, R4S, Marksville Quadrangle. Sample 246 taken from east side of pit, sample 247 from north side of pit.

Locality 250: Auger hole at Irene, La., Sec. 79, T5S, R1W, Zachary Quadrangle, northeast corner of intersection. Auger samples checked: 40 foot sample, 65 foot sample.

APPENDIX II

Sieve Analysis Summary Sheets

Key: Each page contains the results of sieve analysis of two replicate splits for each sample.

Size Class= in phi units.

Wt.= weight in grams collected on each sieve after sieving.

Perc.= percentage of total weight on each sieve after sieving.

Cum. Per.= cummulative percentage of individual sieve percentages.

UNIT NUMBER: 12

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.71	3.90	2.10	5.19	3.30	4.65	4.65	6.45
PERC.	0.00	0.21	1.13	0.61	1.51	0.96	1.35	1.35	1.87
CUM.PERC.	0.00	0.21	1.34	1.95	3.46	4.42	5.77	7.12	8.99

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	11.10	41.00	132.60	98.35	22.00	6.20	1.65	0.10
PERC.	3.23	11.92	38.55	28.59	6.40	1.80	0.48	0.03
CUM.PERC.	12.22	24.14	62.92	91.29	97.68	99.48	99.96	99.99

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.71	3.90	2.10	5.19	2.70	5.20	4.40	6.00
PERC.	0.00	0.21	1.13	0.61	1.50	0.78	1.50	1.27	1.73
CUM.PERC.	0.00	0.21	1.33	1.94	3.44	4.21	5.71	6.99	8.72

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	10.85	38.75	133.90	100.50	22.80	6.40	2.50	0.30
PERC.	3.13	11.19	38.68	29.03	6.59	1.85	0.72	0.86
CUM.PERC.	11.85	23.04	61.72	90.75	97.33	99.18	99.91	99.99

UNIT NUMBER: 34

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	0.10	0.10	0.50	34.80	141.00	189.50	64.45	15.70
PERC.	0.02	0.02	0.11	7.80	31.60	42.47	14.45	3.52
CUM.PERC.	0.02	0.04	0.16	7.96	39.56	82.03	96.48	100.00

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	0.10	0.10	0.40	23.90	110.60	165.10	51.20	12.20
PERC.	0.03	0.03	0.11	6.57	30.42	45.41	14.08	3.36
CUM.PERC.	0.03	0.05	0.16	6.74	37.16	82.56	96.64	100.00

UNIT NUMBER: 36

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.35	0.90	1.90	4.60
PERC.	0.00	0.00	0.00	0.00	0.00	0.06	0.16	0.34	0.83
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.06	0.23	0.57	1.40

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	14.30	67.25	191.30	185.50	59.65	21.30	3.80	0.90
PERC.	2.59	12.19	34.67	33.62	10.81	3.86	0.69	0.16
CUM.PERC.	4.00	16.18	50.85	84.48	95.29	99.15	99.84	100.00

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.40	0.90	1.85	4.90
PERC.	0.00	0.00	0.00	0.00	0.00	0.07	0.17	0.34	0.91
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.07	0.24	0.58	1.49

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	13.60	68.65	187.90	178.60	57.40	20.10	4.10	1.10
PERC.	2.52	12.72	34.83	33.10	10.64	3.72	0.76	0.20
CUM.PERC.	4.01	16.73	51.56	84.67	95.31	99.03	99.79	99.99

UNIT NUMBER: 38 A

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	1.95	0.20	0.20	0.20	0.30
PERC.	0.00	0.00	0.00	0.00	0.41	0.04	0.04	0.04	0.06
CUM.PERC.	0.00	0.00	0.00	0.00	0.41	0.45	0.49	0.53	0.59

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	0.60	3.50	18.50	58.30	48.90	312.10	28.50	7.70
PERC.	0.12	0.73	3.85	12.12	10.17	64.89	5.93	1.60
CUM.PERC.	0.71	1.44	5.29	17.41	27.58	92.47	98.40	100.00

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	1.95	0.20	0.20	0.20	0.30
PERC.	0.00	0.00	0.00	0.00	0.40	0.04	0.04	0.04	0.06
CUM.PERC.	0.00	0.00	0.00	0.00	0.40	0.44	0.48	0.52	0.58

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	0.60	4.00	19.00	57.00	42.90	324.80	25.50	7.90
PERC.	0.12	0.83	3.92	11.76	8.85	67.04	5.26	1.63
CUM.PERC.	0.70	1.53	5.45	17.21	26.06	93.11	98.37	100.00

UNIT NUMBER: 38 B

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.40
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.07
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.09

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	1.50	15.60	120.00	228.10	48.10	138.00	24.30	11.60
PERC.	0.25	2.65	20.42	38.81	8.18	23.48	4.13	1.97
CUM.PERC.	0.34	2.99	23.41	62.22	70.40	93.88	98.01	99.98

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.40
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.07
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.09

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	1.30	13.10	115.40	224.80	47.30	136.60	22.90	10.70
PERC.	0.23	2.29	20.15	39.26	8.26	23.86	4.00	1.87
CUM.PERC.	0.32	2.61	22.76	62.02	70.28	94.14	98.00	100.01

UNIT NUMBER: 38C

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.70	0.10	0.20	0.40	0.90
PERC.	0.00	0.00	0.00	0.00	0.15	0.02	0.04	0.09	0.19
CUM.PERC.	0.00	0.00	0.00	0.00	0.15	0.17	0.21	0.30	0.49

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	2.20	11.90	39.00	85.20	81.30	206.20	32.20	10.10
PERC.	0.47	2.53	8.29	18.11	17.28	43.84	6.58	2.15
CUM.PERC.	0.96	3.49	11.78	29.89	47.17	91.00	97.85	100.00

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.70	0.15	0.30	0.40	0.90
PERC.	0.00	0.00	0.00	0.00	0.15	0.03	0.06	0.09	0.19
CUM.PERC.	0.00	0.00	0.00	0.00	0.15	0.18	0.24	0.32	0.52

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	2.30	11.50	38.20	82.50	73.00	210.90	32.80	10.80
PERC.	0.50	2.48	8.22	17.76	15.72	45.41	7.06	2.33
CUM.PERC.	1.02	3.50	11.72	29.48	45.20	90.61	97.67	100.00

UNIT NUMBER: 47

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.47	9.20	6.20	16.48	11.20	20.30	22.40	33.50
PERC.	0.00	0.07	1.31	0.88	2.35	1.60	2.89	3.19	4.77
CUM.PERC.	0.00	0.07	1.38	2.26	4.61	6.20	9.09	12.29	17.06

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	60.10	21.98	192.20	86.30	16.10	4.70	2.60	0.30
PERC.	8.56	31.32	27.38	12.30	2.29	0.67	0.37	0.04
CUM.PERC.	25.62	56.94	84.32	96.62	98.91	99.58	99.95	99.99

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.47	9.20	6.20	16.48	11.10	20.00	22.75	31.80
PERC.	0.00	0.07	1.31	0.88	2.35	1.58	2.85	3.24	4.53
CUM.PERC.	0.00	0.07	1.37	2.26	4.60	6.18	9.03	12.26	16.79

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	57.80	219.70	192.50	89.60	17.50	5.00	2.40	0.20
PERC.	8.23	31.27	27.39	12.75	2.49	0.71	0.34	0.28
CUM.PERC.	25.01	56.28	83.67	96.42	98.91	99.62	99.97	99.99

UNIT NUMBER: 50

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.70
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.65
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.70
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	10.15	35.50	73.20	132.10	79.80	48.00	21.85	13.10	
PERC.	2.44	8.52	17.57	31.71	19.16	11.52	5.24	3.14	
CUM.PERC.	3.14	11.66	29.23	60.94	80.10	91.62	96.86	100.00	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.30	2.30
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.07	0.55
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.12	0.67
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	9.60	35.00	74.00	134.30	83.30	43.60	23.50	12.60	
PERC.	2.29	8.36	17.67	32.07	19.89	10.41	5.61	3.01	
CUM.PERC.	2.96	11.32	28.99	61.06	80.95	91.36	96.97	99.98	

UNIT NUMBER: 54

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.10	0.80
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.14
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.16
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	3.40	22.10	89.30	216.50	135.30	72.00	19.70	4.35	
PERC.	0.60	3.92	15.85	38.42	24.01	12.78	3.50	0.77	
CUM.PERC.	0.76	4.68	20.53	58.95	82.96	95.74	99.24	100.00	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.70
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	3.20	22.80	87.10	215.30	140.20	71.10	20.20	4.60	
PERC.	0.57	4.03	15.41	38.09	24.81	12.58	3.57	0.81	
CUM.PERC.	0.69	4.72	20.13	58.22	83.03	95.61	99.18	99.99	

UNIT NUMBER: 55

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.65	1.35	0.60	0.30	0.20	0.20
PERC.	0.00	0.00	0.00	0.11	0.24	0.11	0.05	0.03	0.03
CUM.PERC.	0.00	0.00	0.00	0.11	0.35	0.46	0.51	0.54	0.57

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	2.10	30.30	154.80	259.30	67.90	28.70	15.60	9.40
PERC.	0.37	5.30	27.09	45.38	11.88	5.02	2.73	1.65
CUM.PERC.	0.94	6.24	33.33	78.71	90.59	95.61	98.34	99.99

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.65	1.35	0.60	0.50	0.30	0.20
PERC.	0.00	0.00	0.00	0.11	0.24	0.10	0.09	0.05	0.03
CUM.PERC.	0.00	0.00	0.00	0.11	0.35	0.45	0.54	0.59	0.62

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	2.10	29.90	148.90	263.70	72.00	29.40	15.80	9.00
PERC.	0.37	5.21	25.92	45.91	12.53	5.12	2.75	1.57
CUM.PERC.	0.99	6.20	32.12	78.03	90.56	95.68	98.43	100.00

UNIT NUMBER: 60

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.30	1.35
PERC.	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.04	0.19
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.06	0.26

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	5.70	17.30	38.70	151.90	325.65	125.80	19.60	3.70
PERC.	0.82	2.51	5.61	22.01	47.18	18.23	2.84	0.54
CUM.PERC.	1.09	3.60	9.21	31.22	78.40	96.63	99.47	100.01

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.50	1.40
PERC.	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.72	0.20
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.10	0.30

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	5.50	18.70	36.75	165.60	325.75	115.00	19.50	5.30
PERC.	0.79	2.69	5.29	23.85	46.92	16.57	2.81	0.76
CUM.PERC.	1.09	3.78	9.07	32.92	79.84	96.41	99.22	99.98

UNIT NUMBER: 61

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.05	0.00	0.00	0.05	0.05	0.10
PERC.	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.03
CUM.PERC.	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.06

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	0.40	3.80	11.85	113.30	146.75	78.50	15.40	4.80
PERC.	0.11	1.01	3.16	30.21	39.13	20.93	4.11	1.28
CUM.PERC.	0.17	1.18	4.34	34.55	73.68	94.61	98.22	100.00

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.05	0.00	0.00	0.05	0.05	0.01
PERC.	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.03
CUM.PERC.	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.06

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	0.60	2.80	11.10	110.60	148.40	82.30	15.30	3.70
PERC.	0.16	0.75	2.96	29.49	39.57	21.94	4.08	0.99
CUM.PERC.	0.22	0.97	3.93	33.42	72.99	94.93	99.01	100.00

UNIT NUMBER: 63

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	1.15	1.06	3.20	3.20	4.30	5.50	15.30
PERC.	0.00	0.00	0.14	0.13	0.40	0.40	0.54	0.69	1.92
CUM.PERC.	0.00	0.00	0.14	0.27	0.67	1.07	1.61	2.30	4.22
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	38.80	111.40	151.00	228.10	120.40	72.35	28.80	12.00	
PERC.	4.87	13.99	18.96	28.64	15.11	9.08	3.61	1.51	
CUM.PERC.	9.09	23.08	42.04	70.68	85.79	94.87	98.48	99.99	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	1.15	1.06	3.20	3.50	4.50	5.70	15.15
PERC.	0.00	0.00	0.14	0.13	0.39	0.43	0.55	0.70	1.85
CUM.PERC.	0.00	0.00	0.14	0.27	0.66	1.09	1.64	2.34	4.19
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	39.80	97.00	175.50	232.20	124.50	73.60	30.90	12.15	
PERC.	4.85	11.83	21.40	28.32	15.18	8.98	3.77	1.48	
CUM.PERC.	9.04	20.87	42.27	70.59	85.77	94.75	98.52	100.00	

UNIT NUMBER: 64

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	1.30	3.20	2.20	2.25	2.10	4.30
PERC.	0.00	0.00	0.00	0.27	0.67	0.46	0.47	0.44	0.91
CUM.PERC.	0.00	0.00	0.00	0.27	0.94	1.40	1.87	2.31	3.22

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	11.20	35.20	82.70	154.90	84.50	46.40	28.30	15.10
PERC.	2.36	7.43	17.46	32.70	17.84	9.80	5.97	3.19
CUM.PERC.	5.58	13.01	30.47	63.17	81.01	90.81	96.78	99.97

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	1.30	3.20	1.80	2.40	2.10	4.60
PERC.	0.00	0.00	0.00	0.31	0.76	0.43	0.57	0.50	1.09
CUM.PERC.	0.00	0.00	0.00	0.31	1.07	1.50	2.07	2.57	3.66

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	10.70	31.90	72.00	138.60	73.30	40.30	24.30	13.30
PERC.	2.55	7.60	17.15	33.01	17.46	9.60	5.79	3.17
CUM.PERC.	6.21	13.81	30.96	63.97	81.43	91.03	96.82	99.99

UNIT NUMBER: 64 A

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.26	4.96	2.94	2.88	1.46	1.50	2.00	4.60
PERC.	0.00	0.07	1.38	0.68	0.80	0.40	0.42	0.56	1.28
CUM.PERC.	0.00	0.07	1.45	2.13	2.93	3.33	3.75	4.31	5.59
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	12.30	58.10	79.80	101.30	44.15	27.55	11.50	4.35	
PERC.	3.42	16.18	22.22	28.21	12.29	7.67	3.20	1.21	
CUM.PERC.	9.01	25.19	47.41	75.62	87.91	95.58	98.78	99.99	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.26	4.96	2.44	2.88	1.30	1.40	1.80	4.20
PERC.	0.00	0.08	1.49	0.73	0.86	0.39	0.42	0.54	1.26
CUM.PERC.	0.00	0.08	1.57	2.30	3.16	3.55	3.97	4.51	5.77
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	11.50	51.60	74.90	93.80	41.40	25.85	10.80	4.00	
PERC.	3.45	15.49	22.49	28.16	12.43	7.76	3.24	1.21	
CUM.PERC.	9.22	24.71	47.20	75.36	87.79	95.55	98.79	100.00	

UNIT NUMBER: 68

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	359.95	602.25	184.37	308.43	134.75	124.90	60.90	51.60
PERC.	0.00	15.76	26.37	8.07	13.51	5.90	5.47	2.67	2.26
CUM.PERC.	0.00	15.76	42.13	50.20	63.71	69.61	75.08	77.75	80.01
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	50.40	78.20	101.00	107.20	53.20	23.90	32.30	10.30	
PERC.	2.21	3.42	4.42	4.69	2.33	1.05	1.41	0.45	
CUM.PERC.	82.22	85.64	90.06	94.75	97.08	98.13	99.54	99.99	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	359.95	602.25	184.37	308.43	129.30	120.85	59.20	52.40
PERC.	0.00	15.87	26.55	8.13	13.60	5.70	5.33	2.61	2.31
CUM.PERC.	0.00	15.87	42.42	50.55	64.15	69.85	75.18	77.79	80.10
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	51.10	79.00	95.40	107.50	52.30	37.40	20.30	8.60	
PERC.	2.25	3.48	4.21	4.74	2.31	1.65	0.89	0.38	
CUM.PERC.	82.35	85.83	90.04	94.78	97.09	98.74	99.63	100.00	

UNIT NUMBER: 68 A

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	2.65	10.20	1.35	4.17	1.50	2.50	3.35	7.15
PERC.	0.00	0.62	2.32	0.31	0.95	0.34	0.57	0.76	1.62
CUM.PERC.	0.00	0.60	2.92	3.23	4.18	4.52	5.09	5.85	7.47
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	13.70	32.10	49.70	79.65	72.20	83.30	47.80	28.70	
PERC.	3.11	7.29	11.29	18.10	16.41	18.93	10.86	6.52	
CUM.PERC.	10.58	17.87	29.16	47.26	63.67	82.60	93.46	99.98	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	2.65	10.20	1.35	4.17	1.50	3.00	3.40	6.70
PERC.	0.00	0.62	2.39	0.32	0.98	0.35	0.70	0.80	1.57
CUM.PERC.	0.00	0.62	3.01	3.33	4.31	4.66	5.36	6.16	7.73
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	13.70	32.60	48.80	78.90	69.40	80.40	49.10	21.10	
PERC.	3.21	7.63	11.43	18.48	16.25	18.83	11.50	4.94	
CUM.PERC.	10.94	18.57	30.00	48.48	64.73	83.56	95.06	100.00	

UNIT NUMBER: 73

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.28	0.26	1.33	1.20	1.70	3.00	10.70
PERC.	0.00	0.00	0.08	0.08	0.40	0.36	0.51	0.90	3.22
CUM.PERC.	0.00	0.00	0.08	0.16	0.56	0.92	1.43	2.33	5.55

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	30.30	85.00	100.10	61.30	19.55	10.10	4.70	2.35
PERC.	9.13	25.61	30.16	18.47	5.89	3.04	1.42	0.71
CUM.PERC.	14.68	40.29	70.45	88.92	94.81	97.85	99.27	99.98

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.28	0.26	1.33	1.20	2.30	3.30	11.40
PERC.	0.00	0.00	0.08	0.08	0.40	0.36	0.69	1.00	3.44
CUM.PERC.	0.00	0.00	0.08	0.16	0.56	0.92	1.61	2.61	6.05

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	34.50	80.00	97.80	62.50	18.70	10.10	4.90	2.35
PERC.	10.43	24.17	29.55	18.89	5.65	3.05	1.48	0.71
CUM.PERC.	16.48	40.65	70.20	89.09	97.74	97.79	99.27	99.98

UNIT NUMBER: 74

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	1.30	2.70	39.30	181.40	177.70	121.70	40.20	15.60	
PERC.	0.22	0.47	0.77	31.27	30.63	20.97	6.93	2.69	
CUM.PERC.	0.27	0.74	7.51	38.78	69.41	90.38	97.31	100.00	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	1.00	3.50	29.45	168.00	182.30	131.90	42.70	15.40	
PERC.	0.17	0.60	5.09	29.02	34.49	22.79	8.15	2.66	
CUM.PERC.	0.19	0.79	5.88	34.90	66.39	89.18	97.33	99.99	

UNIT NUMBER: 75 A

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	159.56	174.44	40.00	39.00	34.50	35.50	23.00	29.00
PERC.	0.00	16.45	17.98	4.12	4.02	3.56	3.66	2.37	2.99
CUM.PERC.	0.00	16.45	34.43	38.55	42.57	46.13	49.79	52.16	55.15
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	61.00	139.00	121.50	62.75	22.00	14.50	9.75	4.75	
PERC.	6.29	14.33	12.52	6.47	2.27	1.49	1.00	0.49	
CUM.PERC.	61.44	75.77	88.29	94.76	97.03	98.52	99.56	100.05	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	159.56	174.44	40.00	39.00	33.00	35.00	22.50	32.25
PERC.	0.00	16.49	18.03	4.13	4.03	3.41	3.62	2.33	2.33
CUM.PERC.	0.00	16.49	34.52	38.65	42.68	46.09	49.71	52.04	55.37
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	58.50	144.00	115.00	63.25	22.00	14.25	9.50	5.25	
PERC.	6.05	14.88	11.89	6.54	2.27	1.47	0.98	0.54	
CUM.PERC.	61.42	76.30	88.19	94.73	97.00	98.47	99.45	99.99	

UNIT NUMBER: 75 B

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	66.56	104.25	32.00	68.75	11.50	1.75	2.50	8.75
PERC.	0.00	8.16	12.78	3.93	8.43	1.41	0.21	0.31	1.07
CUM.PERC.	0.00	8.16	20.94	24.87	33.30	34.71	34.92	35.23	36.30

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	63.25	261.25	146.50	34.50	5.75	4.00	2.75	1.50
PERC.	7.76	32.03	17.96	4.23	0.71	0.49	0.34	0.18
CUM.PERC.	44.03	76.09	94.05	98.28	98.99	99.48	99.82	100.00

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	66.56	104.25	32.00	68.75	10.00	2.25	2.00	8.50
PERC.	0.00	8.21	12.86	3.95	8.48	1.23	0.28	0.25	1.05
CUM.PERC.	0.00	8.21	21.07	25.02	33.50	34.73	35.01	35.26	36.31

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	63.75	258.00	146.75	33.50	5.75	4.00	2.75	1.75
PERC.	7.86	31.38	18.10	4.13	0.71	0.49	0.34	0.22
CUM.PERC.	44.17	76.00	94.10	98.23	98.94	99.43	99.77	99.99

UNIT NUMBER: 75 D

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	68.37	469.63	345.38	85.31	90.50	41.25	43.00	26.75	37.00
PERC.	4.40	30.23	22.23	5.49	5.83	2.65	2.77	1.72	2.38
CUM.PERC.	4.40	34.63	56.86	62.35	68.18	70.83	73.60	75.32	77.70
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	56.50	101.25	89.25	45.75	17.50	17.00	13.50	5.50	
PERC.	3.64	6.52	5.75	2.95	1.13	1.09	0.87	0.35	
CUM.PERC.	81.34	87.86	93.61	96.56	97.69	98.78	99.65	100.00	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	68.37	469.63	345.38	85.31	90.50	40.25	43.00	25.00	34.75
PERC.	4.35	31.28	23.01	5.68	6.03	2.68	2.87	1.67	2.31
CUM.PERC.	4.55	35.83	58.84	64.52	70.55	73.23	76.10	77.77	80.08
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	50.75	87.75	78.00	39.25	14.75	14.25	10.25	4.00	
PERC.	3.38	5.85	5.20	2.61	0.98	0.95	0.68	0.27	
CUM.PERC.	83.46	89.31	94.51	97.12	98.10	99.05	99.73	100.00	

UNIT NUMBER: 77

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	14.93	40.36	15.94	27.56	28.70	28.40	34.21	67.95
PERC.	0.00	1.57	4.23	1.67	2.89	3.01	2.98	3.59	7.13
CUM.PERC.	0.00	1.57	5.80	7.47	10.36	13.37	16.35	19.94	27.07

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	97.70	144.50	149.60	177.10	67.10	35.20	16.65	6.90
PERC.	10.25	15.17	15.70	18.59	7.04	3.69	1.75	0.72
CUM.PERC.	37.32	52.49	68.19	86.78	93.82	97.44	99.19	99.91

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	14.93	40.36	15.94	27.56	24.20	24.35	32.65	64.00
PERC.	0.00	1.67	4.56	1.80	3.11	2.73	2.75	3.69	7.23
CUM.PERC.	0.00	1.67	6.23	8.03	11.14	13.87	16.62	20.31	27.54

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	92.45	146.30	119.30	164.75	63.40	34.00	15.75	5.20
PERC.	10.44	16.53	13.48	18.72	7.17	3.85	1.78	0.59
CUM.PERC.	37.98	54.51	67.99	86.71	93.88	97.73	99.51	100.10

UNIT NUMBER: 78 B

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	269.25	1012.50	591.00	645.10	204.20	47.90	67.70	66.20	78.00
PERC.	7.85	29.54	17.24	18.82	5.96	1.40	1.97	1.93	2.27
CUM.PERC.	7.85	37.39	54.63	73.45	79.41	80.81	82.78	84.71	86.98
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	89.25	126.60	128.60	62.30	19.30	11.00	8.20	0.70	
PERC.	2.60	3.69	3.75	1.82	0.56	0.32	0.24	0.02	
CUM.PERC.	89.58	93.27	97.02	98.84	99.40	99.72	99.96	99.98	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	269.25	1012.50	591.00	645.10	204.20	57.80	64.95	63.45	79.10
PERC.	7.84	29.50	17.22	18.79	5.95	1.68	1.89	1.85	2.30
CUM.PERC.	7.84	37.34	54.56	73.35	79.30	80.98	82.87	84.72	87.02
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	105.40	139.55	98.40	60.40	18.55	10.90	9.00	2.80	
PERC.	3.07	4.07	2.87	1.76	0.54	0.32	0.26	0.08	
CUM.PERC.	90.09	94.16	97.03	98.79	99.33	99.65	99.91	99.99	

UNIT NUMBER: 78 A

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.50	6.45	4.60	10.30	15.10	24.70
PERC.	0.00	0.00	0.00	0.11	1.43	1.02	2.29	3.35	5.48
CUM.PERC.	0.00	0.00	0.00	0.11	1.54	2.56	4.85	8.20	13.68

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	35.00	73.40	69.00	87.80	67.00	39.80	13.10	3.75
PERC.	7.77	16.29	15.32	19.49	14.87	8.83	2.91	0.83
CUM.PERC.	21.45	37.74	53.06	72.55	87.42	96.25	99.16	99.99

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.50	6.45	4.80	11.60	14.30	25.85
PERC.	0.00	0.00	0.00	0.11	1.41	1.05	2.53	3.12	5.64
CUM.PERC.	0.00	0.00	0.00	0.11	1.52	2.57	5.10	8.22	13.86

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	40.50	71.60	69.00	90.50	67.70	38.10	12.90	4.40
PERC.	8.84	15.63	15.06	19.75	14.77	8.31	2.81	0.96
CUM.PERC.	22.70	38.33	53.39	73.14	87.91	96.22	99.03	99.99

UNIT NUMBER: 79

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	68.26	173.93	46.39	61.66	20.10	29.70	30.50	40.35
PERC.	0.00	8.97	22.85	6.09	8.10	2.64	3.90	4.01	5.30
CUM.PERC.	0.00	8.97	31.82	37.91	46.01	48.65	52.55	56.56	61.86
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	70.60	91.65	47.35	33.00	21.50	14.00	8.20	4.10	
PERC.	9.27	12.04	6.22	4.33	2.82	1.84	1.08	0.55	
CUM.PERC.	71.13	83.17	89.39	93.72	96.54	98.38	99.46	100.01	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	68.26	173.93	46.39	61.66	21.80	30.10	31.45	43.90
PERC.	0.00	8.98	22.88	6.10	8.11	2.87	3.96	4.14	5.77
CUM.PERC.	0.00	8.98	31.86	37.96	46.07	48.94	52.90	57.04	62.81
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	73.70	86.35	44.35	30.80	22.85	14.05	8.00	2.50	
PERC.	9.70	11.36	5.83	4.06	3.01	1.85	1.06	0.33	
CUM.PERC.	72.51	83.87	89.70	93.76	96.77	98.62	99.68	100.01	

UNIT NUMBER: 80

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	39.47	175.24	43.20	62.94	23.60	41.45	39.50	57.90
PERC.	0.00	3.97	17.65	4.35	6.38	2.38	4.17	3.98	5.83
CUM.PERC.	0.00	3.97	21.62	25.97	32.35	34.73	38.90	42.88	48.71
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	71.30	132.60	149.90	98.85	28.20	14.60	9.20	5.00	
PERC.	7.18	13.35	15.10	9.95	2.84	1.47	0.93	0.50	
CUM.PERC.	55.89	69.24	84.34	94.29	97.13	98.60	99.53	100.03	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	39.47	175.24	43.20	62.94	25.15	45.30	44.30	56.50
PERC.	0.00	3.98	17.66	4.35	6.34	2.53	4.56	4.46	56.69
CUM.PERC.	0.00	3.98	21.64	25.99	32.33	34.86	39.42	43.88	49.57
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	70.30	123.00	158.85	95.35	27.75	14.35	8.80	2.00	
PERC.	7.08	12.39	16.01	9.61	2.79	1.45	0.89	0.20	
CUM.PERC.	56.65	69.04	85.05	94.66	97.45	98.90	99.79	99.99	

UNIT NUMBER: 81 A

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	27.33	316.44	129.57	163.79	45.01	54.90	45.80	56.20
PERC.	0.00	2.35	27.22	11.15	14.09	3.87	4.72	3.94	4.83
CUM.PERC.	0.00	2.35	29.57	40.72	54.81	58.68	63.40	67.34	72.17

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	68.00	90.30	70.90	57.80	18.00	10.80	6.10	1.50
PERC.	5.58	7.77	6.10	4.97	1.55	0.93	0.52	0.13
CUM.PERC.	78.02	85.79	91.89	96.86	98.41	99.34	99.86	99.99

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	27.33	316.44	129.57	163.79	43.10	57.30	46.01	58.05
PERC.	0.00	2.34	27.07	11.08	14.01	3.69	4.90	3.93	4.97
CUM.PERC.	0.00	2.34	29.41	40.49	54.50	58.19	63.09	67.02	71.99

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	65.95	88.20	74.80	59.50	19.00	11.41	6.40	2.20
PERC.	5.64	7.54	6.40	5.09	1.63	0.98	0.55	0.19
CUM.PERC.	77.63	85.17	91.57	96.66	98.29	99.27	99.82	100.01

UNIT NUMBER: 81 B

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	2.95	2.75	5.55	1.85	5.45	10.10	23.50
PERC.	0.00	0.00	0.42	0.39	0.79	0.26	0.77	1.43	3.33
CUM.PERC.	0.00	0.00	0.42	0.81	1.60	1.86	2.63	4.06	7.39

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	46.80	108.30	164.20	228.20	69.30	24.30	9.50	3.30
PERC.	6.63	15.34	23.26	32.32	9.81	3.44	1.35	0.47
CUM.PERC.	14.02	29.36	52.62	84.94	94.75	98.19	99.54	100.00

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	2.95	2.75	5.55	2.10	4.85	9.00	23.10
PERC.	0.00	0.00	0.42	0.39	0.79	0.30	0.69	1.27	3.27
CUM.PERC.	0.00	0.00	0.42	0.81	1.60	1.90	2.59	3.86	7.13

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	46.50	107.50	186.70	214.70	66.30	22.30	8.60	3.00
PERC.	6.59	15.23	26.45	30.42	9.39	3.16	1.22	0.42
CUM.PERC.	13.72	28.95	55.40	85.82	95.21	98.37	99.59	100.01

UNIT NUMBER: 82 A

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	4.50	6.83	12.90	11.70	23.95	27.70	43.60
PERC.	0.00	0.00	0.88	1.34	2.54	2.30	4.71	5.45	8.57
CUM.PERC.	0.00	0.00	0.88	2.22	4.76	7.06	11.77	17.22	25.79

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	53.25	77.20	84.10	94.15	37.40	16.90	9.00	5.30
PERC.	10.47	15.18	16.55	18.51	7.35	3.32	1.77	1.04
CUM.PERC.	36.26	51.44	67.99	86.50	93.85	97.17	98.94	99.98

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	4.50	6.83	12.90	10.30	23.10	28.45	42.00
PERC.	0.00	0.00	0.88	1.34	2.53	2.02	4.53	5.58	8.24
CUM.PERC.	0.00	0.00	0.88	2.22	4.75	6.77	11.30	16.88	25.13

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	52.50	70.40	96.30	90.80	40.30	17.40	8.35	5.50
PERC.	10.30	13.81	18.90	17.82	7.91	3.41	1.64	1.08
CUM.PERC.	35.42	49.23	68.13	85.95	93.86	97.27	98.91	99.99

UNIT NUMBER: 83

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.30	0.03	0.41	0.87	0.40	2.80	7.30	27.70
PERC.	0.00	0.04	0.003	0.05	0.11	0.05	0.36	0.95	3.59
CUM.PERC.	0.00	0.04	0.04	0.09	0.20	0.25	0.61	1.56	5.15
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	81.90	192.40	237.40	156.80	30.30	16.90	10.70	5.10	
PERC.	10.62	24.94	30.71	20.33	3.93	2.19	1.39	0.66	
CUM.PERC.	15.77	40.71	71.42	91.75	95.68	97.87	99.26	99.92	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.30	0.03	0.41	0.87	0.50	2.60	6.30	25.10
PERC.	0.00	0.04	0.004	0.05	0.12	0.07	0.35	0.85	3.40
CUM.PERC.	0.00	0.04	0.04	0.09	0.21	0.28	0.63	1.48	4.88
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	77.00	180.80	227.00	157.30	28.50	16.50	10.10	4.30	
PERC.	10.44	24.51	30.77	21.33	3.86	2.24	1.37	0.58	
CUM.PERC.	15.32	39.83	70.60	91.93	95.79	98.03	99.40	99.98	

UNIT NUMBER: 84

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	3.70
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.49
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.56

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	32.60	178.00	202.70	208.30	84.60	35.10	8.10	2.70
PERC.	4.31	23.53	26.80	27.54	11.19	4.64	1.07	0.36
CUM.PERC.	4.87	28.40	55.20	82.74	93.93	98.57	99.64	100.00

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	3.50
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.46
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.51

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	30.40	172.50	207.40	205.10	88.30	34.90	8.50	2.80
PERC.	4.03	22.88	27.57	27.21	11.71	4.63	1.13	0.37
CUM.PERC.	4.54	27.42	54.93	82.14	93.85	98.48	99.61	99.98

UNIT NUMBER: 86

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.90	1.60
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.18	0.32
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.22	0.54
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	3.50	11.00	25.10	82.60	126.70	145.30	73.50	33.50	
PERC.	0.69	2.18	4.98	16.39	25.14	28.83	14.59	6.65	
CUM.PERC.	1.23	3.41	8.39	24.78	49.92	78.75	93.34	99.99	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.90	1.70
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.19	0.35
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.21	0.56
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	3.40	10.50	25.30	78.40	120.40	142.60	70.50	29.90	
PERC.	0.70	2.17	5.23	16.21	24.89	29.48	14.57	6.18	
CUM.PERC.	1.26	3.43	8.66	24.87	49.76	79.24	93.81	99.99	

UNIT NUMBER: 87

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.73	0.47	4.63	4.70	6.40	7.20	16.30
PERC.	0.00	0.00	0.13	0.08	0.82	0.83	1.13	1.27	2.89
CUM.PERC.	0.00	0.00	0.13	0.21	1.03	1.86	2.99	4.26	7.15

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	48.20	121.40	135.10	123.60	49.30	29.40	11.90	5.20
PERC.	8.54	21.50	23.93	21.89	8.73	5.21	2.11	0.92
CUM.PERC.	15.69	37.19	61.12	83.01	91.74	96.95	99.06	99.98

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.73	0.47	4.63	3.20	5.65	7.20	16.70
PERC.	0.00	0.00	0.13	0.08	0.82	0.57	1.00	1.27	2.96
CUM.PERC.	0.00	0.00	0.13	0.21	1.03	1.60	2.60	3.87	6.83

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	49.90	122.40	137.60	123.30	48.10	28.60	12.50	3.70
PERC.	8.84	21.67	24.37	21.83	8.52	5.06	2.21	0.65
CUM.PERC.	15.67	37.34	61.71	83.54	92.06	97.12	99.33	99.98

UNIT NUMBER: 89

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.14	0.22	1.24	3.80	9.40	14.15	32.80
PERC.	0.00	0.00	0.02	0.04	0.21	0.63	1.56	2.35	5.45
CUM.PERC.	0.00	0.00	0.02	0.06	0.27	0.90	2.46	4.81	10.26

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	61.85	127.70	152.50	125.90	42.20	21.00	8.35	0.90
PERC.	10.27	21.21	25.33	20.91	7.01	3.49	1.39	0.15
CUM.PERC.	20.53	41.74	67.07	87.98	94.99	98.48	99.87	100.02

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.14	0.22	1.24	4.20	8.50	14.00	28.60
PERC.	0.00	0.00	0.02	0.04	0.21	0.72	1.46	2.40	4.91
CUM.PERC.	0.00	0.00	0.02	0.06	0.27	0.99	2.45	4.85	9.76

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	53.20	136.70	141.35	123.90	41.50	19.50	8.50	1.50
PERC.	9.12	23.45	24.24	21.25	7.12	3.34	1.46	0.26
CUM.PERC.	18.81	42.33	66.57	87.82	94.94	98.28	99.74	100.00

UNIT NUMBER: 90 A

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.20	3.30	11.80
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.51	1.84
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.54	2.38
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	28.50	83.85	113.55	149.05	93.40	93.30	47.60	15.50	
PERC.	4.45	13.10	17.74	23.29	14.59	14.58	7.44	2.42	
CUM.PERC.	6.83	19.93	37.67	60.96	75.55	90.13	97.57	99.99	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.20	3.60	12.35
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.56	1.92
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.59	2.51
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	29.40	86.00	113.00	149.90	92.80	85.75	51.95	18.20	
PERC.	4.57	13.37	17.54	23.31	14.43	13.33	8.08	2.83	
CUM.PERC.	7.08	20.45	37.99	61.30	75.73	89.06	97.14	99.97	

UNIT NUMBER: 91 gravel

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	17.19	120.50	61.94	103.06	29.1	50.5	32.3	38.3
PERC.	0.00	2.01	14.11	7.25	12.07	3.41	5.91	3.78	4.49
CUM.PERC.	0.00	2.01	16.12	23.37	35.44	38.85	44.76	48.54	53.03

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	56.3	109.15	107.00	100.90	19.50	5.60,	2.00	0.80
PERC.	6.59	12.78	12.53	11.81	2.26	0.65	0.23	0.09
CUM.PERC.	59.62	72.40	84.93	96.74	99.00	99.65	99.88	99.97

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	17.19	120.50	61.94	103.06	32.40	50.60	30.10	35.40
PERC.	0.00	2.01	14.11	7.25	12.07	3.79	5.93	3.52	4.15
CUM.PERC.	0.00	2.01	16.12	23.37	35.44	39.23	45.16	48.68	52.83

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	54.10	107.10	115.30	99.70	18.50	5.30	2.00	0.80
PERC.	6.33	12.54	13.50	11.67	2.17	0.62	0.23	0.09
CUM.PERC.	59.16	71.70	85.20	96.87	99.04	99.66	99.89	99.98

UNIT NUMBER: 91 grit

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	7.64	3.23	6.63	4.00	9.00	14.00	38.70
PERC.	0.00	0.00	1.67	0.71	1.45	0.88	1.97	3.07	8.48
CUM.PERC.	0.00	0.00	1.67	2.38	3.83	4.71	6.68	9.75	18.23
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	95.20	161.40	78.00	23.50	9.50	3.20	1.50	0.80	
PERC.	20.86	35.37	17.09	5.15	2.08	0.70	0.33	0.17	
CUM.PERC.	39.09	74.46	91.55	96.70	98.78	99.48	99.81	99.98	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	7.64	3.23	6.63	4.20	10.30	16.30	43.60
PERC.	0.00	0.00	1.51	0.64	1.31	0.83	2.04	3.23	8.64
CUM.PERC.	0.00	0.00	1.51	2.15	3.46	4.29	6.33	9.56	18.20
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	101.90	178.90	89.10	26.30	10.40	3.50	1.70	0.80	
PERC.	20.20	35.46	17.66	5.21	2.06	0.69	0.34	0.16	
CUM.PERC.	38.40	73.86	91.52	96.73	98.79	99.48	99.82	99.98	

UNIT NUMBER: 92 B

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.23	2.95	1.50	1.20	1.60	3.20
PERC.	0.00	0.00	0.00	0.03	0.37	0.19	0.15	0.20	0.40
CUM.PERC.	0.00	0.00	0.00	0.03	0.40	0.59	0.74	0.94	1.34

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	6.30	34.60	199.90	369.10	121.70	36.50	11.60	2.50
PERC.	0.79	4.36	25.21	46.55	15.35	4.60	1.46	0.31
CUM.PERC.	2.13	6.49	31.70	78.25	93.60	98.20	99.66	99.97

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.23	2.95	1.40	1.20	1.50	3.00
PERC.	0.00	0.00	0.00	0.03	0.36	0.17	0.15	0.18	0.37
CUM.PERC.	0.00	0.00	0.00	0.03	0.39	0.56	0.71	0.89	1.26

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	6.40	34.10	166.50	415.50	127.30	38.50	12.40	2.40
PERC.	0.79	4.19	20.47	51.08	15.65	4.73	1.52	0.29
CUM.PERC.	2.05	6.24	26.71	77.79	93.44	98.17	99.69	99.98

UNIT NUMBER: 93 A

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	1.20	5.41	20.00	16.20	42.00	56.10	95.20
PERC.	0.00	0.00	0.13	0.61	2.25	1.83	4.73	6.32	10.73
CUM.PERC.	0.00	0.00	0.13	0.74	2.99	4.82	9.55	15.87	26.60

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	14.04	204.07	153.00	83.50	30.60	20.30	12.70	5.70
PERC.	15.83	23.08	17.25	9.41	3.45	2.29	1.43	0.64
CUM.PERC.	42.43	65.51	82.76	92.17	95.62	97.91	99.34	99.98

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	1.20	5.41	20.00	17.90	46.20	59.00	98.15
PERC.	0.00	0.00	0.13	0.60	2.21	1.98	5.12	6.53	10.87
CUM.PERC.	0.00	0.00	0.13	0.73	2.94	4.92	10.04	16.57	27.44

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	142.00	207.20	147.05	85.70	31.60	21.75	12.10	7.50
PERC.	15.73	222.95	16.29	9.49	3.50	2.41	11.34	0.83
CUM.PERC.	43.17	66.12	82.41	91.90	95.40	97.81	99.15	99.98

UNIT NUMBER: 94

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.50	1.09	5.90	9.50	20.80	31.50	47.80
PERC.	0.00	0.00	0.11	0.24	1.32	2.12	4.65	7.04	10.69
CUM.PERC.	0.00	0.00	0.11	0.35	1.67	3.79	8.44	15.48	26.17

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	63.10	80.60	84.20	59.70	22.90	11.30	4.70	3.70
PERC.	14.11	18.02	18.82	13.35	5.12	2.53	1.05	0.83
CUM.PERC.	40.28	58.30	72.12	90.47	95.59	98.12	99.17	100.00

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.50	1.09	5.90	12.70	22.60	30.10	46.50
PERC.	0.00	0.00	0.11	0.25	1.33	2.86	5.09	6.77	10.47
CUM.PERC.	0.00	0.00	0.11	0.36	1.69	4.55	9.64	16.41	26.88

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	60.90	82.70	78.10	60.70	23.40	11.10	4.60	3.40
PERC.	13.71	18.61	17.58	13.66	5.27	2.50	1.03	0.77
CUM.PERC.	40.59	59.20	76.78	90.44	95.71	98.21	99.24	100.01

UNIT NUMBER: 95 A

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	7.64	185.46	161.96	38.65	53.61	24.40	36.80	31.90	49.00
PERC.	0.73	17.86	15.60	3.72	5.16	2.35	3.54	3.07	4.72
CUM.PERC.	0.73	18.59	34.19	37.91	43.07	45.42	48.96	52.03	56.75
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	103.90	196.50	102.90	38.40	5.00	1.70	0.60	0.10	
PERC.	10.00	18.92	9.91	3.70	0.48	0.16	0.06	0.01	
CUM.PERC.	66.76	85.68	95.59	99.28	99.76	99.93	99.98	99.99	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	7.64	185.46	161.96	38.65	53.61	22.25	35.40	29.50	48.75
PERC.	0.73	17.83	15.57	3.72	5.15	2.14	3.40	2.84	4.69
CUM.PERC.	0.73	18.57	34.14	37.85	43.01	45.15	48.55	51.39	56.07
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	97.85	193.40	119.60	37.90	5.40	1.90	0.70	0.10	
PERC.	9.41	18.59	11.50	3.64	0.52	0.18	0.07	0.01	
CUM.PERC.	65.48	84.07	95.57	99.22	99.24	99.92	99.98	99.99	

UNIT NUMBER: 100

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	18.2	108.36	35.66	60.37	36.40	48.70	37.60	44.40
PERC.	0.00	1.55	9.20	3.03	5.13	3.09	4.14	3.19	3.77
CUM.PERC.	0.00	1.55	10.75	13.78	18.90	22.00	26.13	29.32	33.09

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	59.01	110.30	153.10	276.70	142.10	36.70	8.50	1.10
PERC.	5.02	9.37	13.00	23.50	12.07	3.12	0.72	0.09
CUM.PERC.	38.11	47.48	60.49	83.99	96.06	99.18	99.90	99.99

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	18.2	108.36	35.66	60.37	36.55	49.10	39.40	42.50
PERC.	0.00	1.55	9.20	3.03	5.13	3.11	4.17	3.35	3.61
CUM.PERC.	0.00	1.55	10.75	13.78	18.91	22.02	26.19	29.53	33.14

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	59.45	117.60	148.55	274.55	142.25	36.30	7.75	0.40
PERC.	5.05	9.99	12.62	23.36	12.09	3.08	0.66	0.03
CUM.PERC.	38.19	48.19	60.80	84.13	96.21	99.30	99.96	99.99

UNIT NUMBER: 115 A

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	0.25	1.50	15.50	89.00	124.50	48.00	5.00	2.00
PERC.	0.08	0.52	5.42	31.34	43.56	16.79	1.74	0.69
CUM.PERC.	0.08	0.60	6.02	37.36	80.92	97.71	99.45	100.14

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	0.25	1.50	16.50	90.00	120.50	51.00	5.50	2.00
PERC.	0.08	0.52	5.74	31.33	41.94	17.75	1.91	0.69
CUM.PERC.	0.08	0.60	6.34	37.67	79.61	97.36	99.27	99.96

UNIT NUMBER: 115 B

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	81.75	161.25	45.75	66.00	36.50	32.00	18.00	18.50
PERC.	0.00	9.71	19.16	5.43	7.84	4.33	3.80	2.13	2.19
CUM.PERC.	0.00	9.71	28.37	34.30	42.40	46.47	50.27	52.40	54.59

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	26.50	91.50	169.50	75.00	10.00	4.00	3.00	2.00
PERC.	3.15	10.87	20.14	8.91	1.18	0.47	0.35	0.23
CUM.PERC.	57.74	68.61	88.75	97.66	98.84	99.31	99.66	99.89

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	81.75	161.25	45.75	66.00	39.50	30.50	16.50	18.00
PERC.	0.00	9.72	19.19	5.44	7.85	4.70	3.62	1.96	2.14
CUM.PERC.	0.00	9.72	28.91	34.35	42.20	46.90	50.52	52.48	54.62

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	25.50	92.50	163.50	79.00	11.00	4.00	3.00	2.50
PERC.	3.03	11.00	19.45	9.40	1.30	0.47	0.35	0.29
CUM.PERC.	57.65	68.65	88.10	97.50	98.80	99.27	99. 62	99.91

UNIT NUMBER: 115 C

SIZE CLASS	−5	−5/−4	−4/−3	−3/−2.5	−2.5/−2	−2/−1.5	−1.5/−1	−1/−0.5	−0.5/0
WT.	0.00	2.88	2.38	1.88	1.75	0.50	0.75	0.50	1.00
PERC.	0.00	1.08	0.89	0.70	0.65	0.18	0.28	0.18	0.37
CUM.PERC.	0.00	1.08	1.97	2.67	3.32	3.50	3.78	3.98	4.33
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	1.25	5.50	24.00	81.00	77.50	49.50	12.00	3.50	
PERC.	0.47	2.06	9.02	30.46	29.14	18.61	4.51	1.31	
CUM.PERC.	4.80	6.86	15.88	46.34	75.48	94.09	98.60	99.91	
SIZE CLASS	−5	−5/−4	−4/−3	−3/−2.5	−2.5/−2	−2/−1.5	−1.5/−1	−1/−0.5	−0.5/0
WT.	0.00	2.88	2.38	1.88	1.75	0.50	0.75	0.50	0.75
PERC.	0.00	1.08	0.89	0.70	0.65	0.18	0.28	0.46	2.06
CUM.PERC.	0.00	1.08	1.97	2.67	3.32	3.50	3.78	3.96	4.24
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	1.25	5.50	24.50	84.00	77.00	48.00	11.50	3.00	
PERC.	0.46	2.06	9.20	31.56	28.93	18.03	4.32	1.12	
CUM.PERC.	4.70	6.76	15.96	47.52	76.45	94.48	98.80	99.92	

UNIT NUMBER: 115 F

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.75	0.25	1.00	0.50	0.50	0.25	0.50
PERC.	0.00	0.00	0.13	0.04	0.18	0.09	0.09	0.04	0.09
CUM.PERC.	0.00	0.00	0.13	0.17	0.35	0.44	0.53	0.57	0.66

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	1.00	21.50	161.50	185.50	121.50	38.50	8.50	2.50
PERC.	0.18	3.95	29.67	34.08	22.32	7.07	1.56	0.45
CUM.PERC.	0.84	4.79	34.46	68.54	90.86	97.93	99.49	99.94

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.75	0.25	1.00	0.50	0.25	0.25	0.25
PERC.	0.00	0.00	0.13	0.04	0.18	0.09	0.04	0.04	0.04
CUM.PERC.	0.00	0.00	0.13	0.17	0.35	0.44	0.48	0.52	0.56

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	1.00	23.50	162.50	180.00	124.50	39.00	8.50	2.50
PERC.	0.18	4.31	29.83	33.04	22.85	7.15	1.56	0.45
CUM.PERC.	0.74	5.05	34.88	67.92	90.77	97.92	99.42	99.93

UNIT NUMBER: 115 G

SIZE CLASS	−5	−5/−4	−4/−3	−3/−2.5	−2.5/−2	−2/−1.5	−1.5/−1	−1/−0.5	−0.5/0
WT.	0.00	454.75	399.50	80.13	101.75	53.50	42.50	19.00	17.50
PERC.	0.00	26.19	23.01	4.61	5.86	3.08	2.45	1.09	1.01
CUM.PERC.	0.00	26.19	49.20	53.81	59.67	62.75	65.20	66.29	67.30
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	26.00	111.00	170.00	182.50	61.00	14.00	2.25	0.75	
PERC.	1.50	6.39	9.79	10.48	3.51	0.81	0.13	0.04	
CUM.PERC.	68.90	75.19	84.98	95.46	98.97	99.78	99.78	99.95	
SIZE CLASS	−5	−5/−4	−4/−3	−3/−2.5	−2.5/−2	−2/−1.5	−1.5/−1	−1/−0.5	−0.5/0
WT.	0.00	454.75	399.50	80.13	101.75	53.50	44.00	20.50	17.50
PERC.	0.00	26.10	22.93	4.60	5.84	3.07	2.53	1.18	1.00
CUM.PERC.	0.00	26.10	49.03	53.63	59.47	62.54	65.07	66.25	67.25
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	27.00	115.00	166.00	184.00	61.00	14.50	2.25	1.00	
PERC.	1.55	6.61	9.53	10.56	3.50	0.83	0.13	0.06	
CUM.PERC.	68.00	75.41	84.94	95.50	99.00	99.83	99.96	100.02	

UNIT NUMBER: 117

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	31.71	477.93	379.05	87.45	119.43	42.50	46.60	31.00	29.60
PERC.	1.73	26.12	20.72	4.78	6.53	2.32	2.55	1.69	1.62
CUM.PERC.	1.73	27.86	48.58	53.36	59.88	62.21	64.75	66.45	68.07
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	51.40	260.10	152.20	86.00	22.40	8.20	3.40	0.50	
PERC.	2.81	14.22	8.32	4.70	1.22	0.45	0.19	0.03	
CUM.PERC.	70.87	85.09	93.41	98.11	99.33	99.78	99.97	100.00	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	31.71	477.93	379.05	87.45	119.43	46.70	46.10	30.10	30.00
PERC.	1.73	26.06	20.67	4.77	6.51	2.55	2.51	1.64	1.63
CUM.PERC.	1.73	27.79	48.45	53.22	59.73	62.28	64.79	66.43	68.06
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	50.20	278.00	139.50	83.10	22.65	8.50	3.40	0.30	
PERC.	2.74	15.16	7.60	4.53	1.23	0.46	0.19	0.02	
CUM.PERC.	70.80	85.96	93.56	98.09	99.33	99.79	99.98	100.00	

UNIT NUMBER: 126

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	7.81	16.14	4.25	7.98	8.70	14.70	13.10	16.00
PERC.	0.00	1.42	2.93	0.77	1.45	1.58	2.67	2.38	2.91
CUM.PERC.	0.00	1.42	4.35	5.13	6.58	8.16	10.83	13.21	16.12
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	22.90	55.10	123.40	168.70	62.30	20.50	5.30	2.90	
PERC.	4.17	10.02	22.44	30.69	11.33	3.73	0.96	0.53	
CUM.PERC.	20.29	30.31	52.75	83.44	94.77	98.50	99.46	99.99	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	7.81	16.14	4.25	7.98	9.20	13.60	13.40	16.10
PERC.	0.00	1.40	2.90	0.76	1.44	1.65	2.45	2.41	2.89
CUM.PERC.	0.00	1.40	4.31	5.07	6.51	8.16	10.61	13.02	15.91
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	23.60	59.45	123.20	168.10	63.75	21.25	6.65	1.50	
PERC.	4.24	10.69	22.16	30.23	11.47	3.82	1.20	0.27	
CUM.PERC.	20.15	30.85	53.01	83.24	94.71	98.63	99.73	100.00	

UNIT NUMBER: 128

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	729.50	441.80	81.50	118.37	34.60	49.00	31.20	34.50
PERC.	0.00	36.51	22.11	4.08	5.92	1.73	2.45	1.56	1.73
CUM.PERC.	0.00	35.51	58.62	62.70	68.62	70.35	72.80	74.36	76.09

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	57.80	163.00	144.70	85.30	18.80	5.00	3.00	0.10
PERC.	2.89	8.16	7.24	4.27	0.94	0.25	0.15	0.01
CUM.PERC.	78.98	87.14	94.38	98.65	99.59	99.84	99.99	100.00

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	729.50	441.80	81.50	118.37	42.40	42.50	31.40	34.00
PERC.	0.00	36.59	22.16	4.09	5.94	2.13	2.13	1.57	1.70
CUM.PERC.	0.00	36.59	58.74	62.83	68.76	70.89	73.02	74.59	76.30

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	57.10	161.60	141.40	79.10	24.40	5.20	3.20	0.50
PERC.	2.86	8.10	7.09	3.96	1.22	0.26	0.16	0.02
CUM.PERC.	79.16	87.72	94.36	98.32	99.55	99.81	99.97	99.99

UNIT NUMBER: 143

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.10
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.02
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.06	0.08

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	0.10	0.10	0.40	7.00	61.50	259.50	121.90	40.60
PERC.	0.02	0.02	0.08	1.42	12.52	52.81	24.80	8.26
CUM.PERC.	0.10	0.12	0.20	1.63	14.14	66.93	91.73	99.99

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.15
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.03
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.07

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	0.01	0.04	0.06	7.70	71.50	273.60	102.20	36.30
PERC.	0.02	0.08	0.12	1.56	14.51	55.53	20.74	7.37
CUM.PERC.	0.09	0.17	0.29	1.85	16.36	71.88	92.63	100.00

UNIT NUMBER: 157

SIZE CLASS	−5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.33	2.25	2.10	7.10	12.70	32.60
PERC.	0.00	0.00	0.00	0.05	0.34	0.31	1.06	1.90	4.87
CUM.PERC.	0.00	0.00	0.00	0.05	0.39	0.70	1.76	3.66	8.53
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	63.20	128.10	175.90	126.70	55.00	34.20	20.70	8.30	
PERC.	9.44	19.14	26.29	18.93	8.22	5.11	3.09	1.24	
CUM.PERC.	17.97	37.11	64.40	82.33	90.55	95.66	98.75	99.99	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.33	2.25	2.90	7.75	13.50	35.70
PERC.	0.00	0.00	0.00	0.05	0.34	0.43	1.16	2.02	5.33
CUM.PERC.	0.00	0.00	0.00	0.05	0.39	0.82	1.98	4.00	9.33
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	61.00	118.50	158.40	149.65	55.00	35.10	20.55	8.30	
PERC.	9.12	17.71	23.68	22.37	8.22	5.25	3.07	1.24	
CUM.PERC.	18.45	36.16	59.84	82.21	90.43	95.68	98.75	99.99	

UNIT NUMBER: 156

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.04	0.00	0.55	1.00	2.00	3.60
PERC.	0.00	0.00	0.00	0.01	0.00	0.15	0.28	0.55	1.00
CUM.PERC.	0.00	0.00	0.00	0.01	0.01	0.16	0.44	0.99	1.99

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	10.50	44.20	112.80	135.70	35.90	10.20	3.90	0.90
PERC.	2.91	12.23	31.22	37.56	9.94	2.82	1.08	0.25
CUM.PERC.	4.90	17.13	48.35	85.91	95.85	98.67	99.75	100.00

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.04	0.00	0.70	1.30	1.70	3.40
PERC.	0.00	0.00	0.00	0.01	0.00	0.19	0.36	0.47	0.94
CUM.PERC.	0.00	0.00	0.00	0.01	0.01	0.20	0.56	1.03	1.97

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	9.60	41.30	116.50	138.10	33.00	9.80	3.95	0.70
PERC.	2.67	11.47	32.35	38.35	9.16	2.72	1.10	0.19
CUM.PERC.	4.64	16.11	48.46	86.81	95.97	98.69	99.79	99.98

UNIT NUMBER: 154

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	14.99	146.15	76.91	115.09	71.20	53.70	36.50	55.40
PERC.	0.00	1.33	13.00	6.84	10.24	6.34	4.78	3.25	4.93
CUM.PERC.	0.00	1.33	14.33	21.17	31.41	37.75	42.53	45.78	50.71

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	99.15	179.10	145.00	99.00	24.90	5.20	1.45	0.60
PERC.	8.82	15.93	12.90	8.81	2.22	0.47	0.13	0.05
CUM.PERC.	59.53	75.46	88.36	97.17	99.39	99.86	99.99	100.04

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	14.99	146.15	76.91	115.09	70.80	50.80	35.09	56.70
PERC.	0.00	1.33	12.96	6.82	10.21	6.28	4.50	3.18	5.03
CUM.PERC.	0.00	1.33	14.29	21.11	31.32	37.60	42.10	45.28	50.31

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	100.70	181.00	148.70	98.10	24.70	5.20	1.40	0.60
PERC.	8.93	16.05	13.19	8.70	2.19	0.46	0.12	0.05
CUM.PERC.	59.24	75.29	88.48	97.22	99.41	99.87	99.99	100.04

UNIT NUMBER: 152 B

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.75	0.00	0.35	0.00	0.30	0.10	0.15
PERC.	0.00	0.00	0.18	0.00	0.08	0.00	0.07	0.02	0.03
CUM.PERC.	0.00	0.00	0.18	0.18	0.26	0.26	0.33	0.35	0.38

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	0.20	0.20	0.30	0.50	1.90	194.60	179.30	40.90
PERC.	0.05	0.05	0.07	0.12	0.45	46.38	42.74	9.75
CUM.PERC.	0.43	0.48	0.55	0.67	1.12	47.50	90.24	100.04

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.75	0.00	0.35	0.00	0.20	0.15	0.20
PERC.	0.00	0.00	0.19	0.00	0.09	0.00	0.05	0.04	0.05
CUM.PERC.	0.00	0.00	0.19	0.19	0.28	0.28	0.33	0.37	0.42

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	0.30	0.40	0.20	0.60	1.90	211.10	157.80	31.40
PERC.	0.07	0.10	0.05	0.15	0.47	52.08	38.93	7.75
CUM.PERC.	0.49	0.59	0.64	0.79	1.26	53.34	92.27	100.02

UNIT NUMBER: 152 D

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	17.45	26.53	55.48	43.05	36.50	19.00	18.05
PERC.	0.00	0.00	2.20	3.34	6.99	5.42	4.60	2.39	2.27
CUM.PERC.	0.00	0.00	2.20	5.54	12.53	17.95	22.55	24.94	27.21
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	24.80	39.60	59.60	141.05	118.00	101.50	58.50	35.10	
PERC.	3.12	4.99	7.50	17.76	14.86	12.78	7.37	4.42	
CUM.PERC.	30.33	35.32	42.86	60.62	75.48	88.26	95.63	100.05	
SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	17.45	26.53	55.48	38.10	39.40	18.80	18.20
PERC.	0.00	0.00	2.22	3.38	7.06	4.85	5.02	2.39	2.32
CUM.PERC.	0.00	0.00	2.22	5.60	12.66	17.51	22.53	24.92	27.24
SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4	
WT.	24.80	40.60	52.50	134.90	118.90	102.50	61.10	36.20	
PERC.	3.16	5.17	6.68	17.17	15.14	13.05	7.78	4.61	
CUM.PERC.	30.40	35.57	42.25	59.42	74.56	87.61	95.39	100.00	

UNIT NUMBER: 150

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.09	0.10	0.00	0.30	1.50
PERC.	0.00	0.00	0.00	0.00	0.02	0.03	0.00	0.08	0.41
CUM.PERC.	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.13	0.54

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	5.30	16.90	36.20	98.90	96.85	64.20	27.70	13.01
PERC.	1.47	4.68	10.02	27.39	26.82	17.78	7.67	3.63
CUM.PERC.	2.01	6.69	16.71	44.10	70.92	88.70	96.37	100.00

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.09	0.10	0.20	0.40	1.80
PERC.	0.00	0.00	0.00	0.00	0.03	0.03	0.60	0.11	0.51
CUM.PERC.	0.00	0.00	0.00	0.00	0.03	0.06	0.12	0.23	0.74

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	5.30	17.10	35.20	97.00	97.00	63.60	27.15	10.60
PERC.	1.49	4.80	9.90	27.28	27.89	17.89	7.64	2.98
CUM.PERC.	2.23	7.04	16.94	44.22	71.58	89.39	97.03	100.01

UNIT NUMBER: 151

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	2.58	7.87	5.30	5.20	7.70	20.10
PERC.	0.00	0.00	0.00	0.37	1.13	0.76	0.75	1.11	2.89
CUM.PERC.	0.00	0.00	0.00	0.37	1.50	2.26	3.01	4.12	7.01

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	46.50	121.50	151.00	171.80	80.00	44.70	23.00	7.20
PERC.	6.70	17.50	21.74	24.74	11.52	6.44	3.31	1.04
CUM.PERC.	13.71	31.21	52.95	77.69	89.21	95.65	98.96	100.00

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	2.58	7.87	5.10	7.55	8.50	19.20
PERC.	0.00	0.00	0.00	0.37	1.13	0.74	1.09	1.23	2.77
CUM.PERC.	0.00	0.00	0.00	0.37	1.50	2.24	3.33	4.56	7.33

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	48.20	115.30	151.65	170.85	79.40	44.30	24.40	8.55
PERC.	6.95	16.63	21.87	24.64	11.45	6.39	3.52	1.23
CUM.PERC.	14.28	30.91	52.78	77.42	88.87	95.26	98.78	100.01

UNIT NUMBER: 151 basal sand

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	0.20	0.50	3.70	378.00	160.00	35.70	5.80	1.30
PERC.	0.03	0.09	0.63	64.58	27.34	6.10	0.99	0.22
CUM.PERC.	0.05	0.14	0.77	65.35	92.69	98.79	99.78	100.00

SIZE CLASS	-5	-5/-4	-4/-3	-3/-2.5	-2.5/-2	-2/-1.5	-1.5/-1	-1/-0.5	-0.5/0
WT.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05
PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CUM.PERC.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01

SIZE CLASS	0/+0.5	+0.5/+1	+1/+1.5	+1.5/+2	+2/+2.5	+2.5/+3	+3/+3.5	+3.5/+4
WT.	0.05	1.00	3.40	357.30	179.10	37.60	6.00	1.20
PERC.	0.00	0.17	0.58	61.00	30.58	6.42	1.02	0.20
CUM.PERC.	0.02	0.20	0.78	61.78	92.36	98.78	99.80	100.00

APPENDIX III

Cumulative Curve Summary Sheets

Key: The data presented in Appendix II were plotted as cumulative curves. The phi value for the 1%, 5%, 16%, 25%, 50%, 75%, 84%, and 95% from the cumulative curve for each replicate analysis (A and B) of each sample are herein presented.

UNIT		1%	5%	16%	25%	50%	75%	84%	95%
12	A	-3.65	-1.50	+0.45	0.75	1.10	1.40	1.55	1.97
	B	-3.65	-1.50	+0.45	+0.75	1.10	1.45	1.60	2.05
34	A	+1.45	+1.65	+1.90	+2.05	2.35	2.65	2.80	3.70
	B	+1.45	+1.70	+1.95	+2.10	2.35	2.65	2.80	3.30
36	A	-0.45	+0.30	+0.75	+0.93	1.25	1.60	1.75	2.23
	B	-0.45	+0.30	+0.75	+0.93	1.25	1.60	1.75	2.23
38 A	A	+0.50	+1.20	+1.70	+2.15	2.40	2.55	2.65	2.90
	B	+0.50	+1.25	+1.70	+2.20	2.40	2.55	2.63	2.85
38 B	A	+0.50	+0.75	+1.15	+1.25	1.60	2.30	2.43	2.85
	B	+0.50	+0.80	+1.15	+1.25	1.60	2.30	2.45	2.80

UNIT		1%	5%	16%	25%	50%	75%	84%	95%
38 C	A	+0.25	+0.90	+1.37	+1.65	2.25	2.50	2.63	2.97
	B	+0.25	+0.90	+1.37	+1.65	2.27	2.55	2.65	3.03
47	A	-3.60	-2.10	-0.35	+0.20	0.65	1.05	1.25	1.65
	B	-3.60	-2.10	-0.35	+0.20	0.65	1.05	1.25	1.65
50	A	-0.50	+0.40	+0.90	+1.17	1.60	2.10	2.45	3.05
	B	-0.15	+0.43	+0.90	+1.17	1.60	2.07	2.45	3.00
54	A	+0.30	+0.75	+1.15	+1.33	1.65	2.05	2.30	2.70
	B	+0.30	+0.75	+1.15	+1.33	1.65	2.05	2.30	2.70
55	A	+0.25	+0.67	+1.00	+1.15	1.43	1.70	1.95	2.65
	B	+0.25	+0.67	+1.00	+1.17	1.45	1.70	1.95	2.65

UNIT		1%	5%	16%	25%	50%	75%	84%	95%
60	A	+0.40	+0.90	+1.45	+1.65	1.95	2.23	2.35	2.73
	B	+0.40	+0.90	+1.40	+1.60	1.95	2.23	2.35	2.73
61	A	+0.70	+1.30	+1.50	+1.65	1.95	2.27	2.45	2.80
	B	+0.70	+1.27	+1.50	+1.65	1.97	2.27	2.45	2.80
63	A	-1.80	-0.17	+0.50	+0.80	1.37	1.85	2.17	2.80
	B	-1.80	-0.17	+0.57	+0.85	1.37	1.85	2.17	2.80
64	A	-2.25	+0.15	0.80	+1.10	1.50	2.05	2.40	3.07
	B	-2.25	+0.05	+0.75	+1.10	1.50	2.00	2.37	2.90
64 A	A	-3.65	-0.40	+0.50	+0.75	1.30	1.75	2.07	2.70
	B	-3.65	-0.50	+0.50	+0.75	1.30	1.75	2.07	2.70

UNIT		1%	5%	16%	25%	50%	75%	84%	95%
68	A	-4.85	-4.70	-4.50	-4.13	-2.75	-1.25	+0.53	+1.80
	B	-4.85	-4.70	-4.50	-4.13	-2.75	-1.25	+0.53	+1.80
68 A	A	-3.75	-1.40	+0.65	1.10	1.85	2.53	2.80	3.27
	B	-3.75	-1.50	+0.60	1.05	1.80	2.50	2.75	3.23
73	A	-1.65	-0.30	+0.25	+0.47	0.90	1.35	1.57	2.30
	B	-1.65	-0.40	+0.20	+0.45	0.90	1.35	1.57	2.30
74	A	+0.95	+0.65	+1.45	+1.60	2.00	2.35	2.55	3.05
	B	+0.95	+0.70	+1.50	+1.65	1.95	2.40	2.60	3.05
75 A	A	-4.90	-4.70	-4.50	-3.95	-1.25	+0.75	1.23	1.80
	B	-4.90	-4.70	-4.50	-3.95	-1.25	+0.75	1.23	1.80

UNIT		1%	5%	16%	25%	50%	75%	84%	95%
75 B	A	-4.80	-4.60	-3.80	-2.75	+0.33	0.73	0.90	1.30
	B	-4.80	-4.60	-3.80	-2.75	+0.33	0.73	0.90	1.30
75 D	A	-5.40	-5.23	-4.85	-4.69	-3.30	-0.85	+0.45	1.32
	B	-5.40	-5.23	-4.85	-4.65	-3.35	-1.40	+0.30	1.45
77	A	-4.60	-3.13	-1.35	-0.37	+0.67	1.43	1.77	2.40
	B	-4.60	-3.20	-1.35	-0.40	+0.60	1.45	1.77	2.37
78 B	A	-5.45	-5.30	-4.95	-4.73	-3.75	-2.63	-0.90	+0.95
	B	-5.45	-5.30	-4.95	-4.73	-3.75	-2.64	-0.90	+0.85
78 A	A	-2.35	-1.20	-0.10	+0.30	+1.17	+1.80	2.10	2.65
	B	-2.35	-1.27	-0.10	+0.25	+1.17	+1.77	2.07	2.05

UNIT		1%	5%	16%	25%	50%	75%	84%	95%
79	A	-4.80	-4.60	-4.10	-3.70	-1.55	+0.37	+0.80	+1.97
	B	-4.80	-4.60	-4.10	-3.70	-1.55	+0.37	+0.80	+1.97
80	A	-4.80	-4.40	-3.73	-2.80	-0.15	+0.90	+1.25	+1.85
	B	-4.80	-4.40	-3.73	-2.80	-0.20	+0.90	+1.20	+1.80
81 A	A	-4.70	-4.25	-3.80	-3.57	-2.40	-0.05	+0.60	+1.55
	B	-4.70	-4.25	-3.80	-3.57	-2.40	+0.03	+0.65	+1.55
81 B	A	-2.60	-0.40	+0.33	+0.63	+1.20	+1.50	+1.70	+2.27
	B	-2.60	-0.40	+0.33	+0.63	+1.15	+1.55	+1.70	+2.20
82 A	A	-3.45	-2.20	-0.85	-0.25	+0.70	+1.40	+1.65	+2.40
	B	-3.45	-2.20	-0.80	-0.25	+0.75	+1.40	+1.70	+2.40

UNIT		1%	5%	16%	25%	50%	75%	84%	95%
83	A	-1.50	-0.75	-0.25	-0.05	+0.40	0.80	1.00	1.65
	B	-1.50	-0.70	-0.25	0.00	+0.43	0.83	1.00	1.65
84	A	-0.15	+0.25	0.55	0.70	1.17	1.60	1.80	2.33
	B	-0.15	+0.27	0.57	0.72	1.17	1.60	1.80	2.33
86	A	+0.1	0.95	1.53	1.75	2.25	2.67	2.90	2.227
	B	+0.1	0.95	1.53	1.75	2.25	2.67	2.90	2.227
87	A	-2.25	-0.60	+0.25	+0.50	1.03	1.55	1.80	1.027
	B	-2.25	-0.50	+0.25	+0.50	1.03	1.55	1.75	2.50
89	A	-1.40	-0.70	+0.10	+0.40	0.90	1.40	1.65	2.25
	B	-1.40	-0.70	+0.10	+0.40	0.90	1.40	1.65	2.25

UNIT		1%	5%	16%	25%	50%	75%	84%	95%
90 A	A	-0.53	+0.10	+0.65	0.90	1.50	2.25	2.50	3.00
	B	-0.53	+0.07	+0.60	0.90	1.50	2.25	2.50	3.05
91 gravel	A	-4.55	-4.10	-3.50	-2.67	-0.60	+0.85	1.20	1.65
	B	-4.55	-4.10	-3.50	-2.67	-0.60	+0.85	1.20	1.65
91 grit	A	-3.62	-1.50	-0.35	-0.50	+0.40	0.75	1.00	1.65
	B	-3.62	-1.60	-0.35	-0.50	+0.40	0.77	1.00	1.65
92 B	A	-0.50	+0.63	+1.00	+1.25	1.45	1.70	1.95	2.43
	B	-0.45	+0.63	+1.05	+1.33	1.43	1.73	1.95	2.43
93 A	A	-2.65	-1.70	-0.75	-0.30	+0.40	1.00	1.30	2.15
	B	-2.65	-1.75	-0.80	-0.35	+0.37	1.00	1.30	2.15

UNIT		1%	5%	16%	25%	50%	75%	84%	95%
94	A	-4.50	-1.57	-0.70	-0.30	+0.50	1.20	1.47	2.20
	B	-4.50	-1.65	-0.75	-0.30	+0.50	1.20	1.47	2.20
95 A	A	-5.20	-4.85	-4.53	-4.05	-1.05	+0.45	+0.70	1.20
	B	-5.20	-4.85	-4.53	-4.05	-1.05	+0.45	+0.70	1.20
100	A	-4.55	-3.95	-2.50	-1.40	+0.85	+1.55	+1.75	2.20
	B	-4.55	-3.95	-2.50	-1.40	+0.85	+1.55	+1.75	2.20
115	A	+0.85	0.70	1.50	1.60	1.90	2.20	2.33	2.53
	B	+0.85	+0.70	1.50	1.60	1.90	2.20	2.33	2.53
115 B	A	-4.90	-4.50	-4.10	-3.65	-1.25	+0.90	+1.15	1.60
	B	-4.90	-4.50	-4.10	-3.65	-1.25	+0.90	+1.15	1.60

UNIT		1%	5%	16%	25%	50%	75%	84%	95%
115 C	A	-4.50	+0.35	1.15	1.35	1.80	2.20	2.45	2.85
	B	-4.50	+0.35	1.15	1.35	1.80	2.20	2.45	2.85
115 F	A	+0.30	+0.73	1.00	1.13	1.50	1.85	2.05	2.50
	B	+0.30	0.73	1.00	1.13	1.50	1.85	2.05	2.50
115 G	A	-4.90	-4.75	-4.60	-4.50	-3.50	+0.75	1.20	1.70
	B	-4.90	-4.75	-4.60	-4.50	-3.50	+0.75	1.20	1.70
117	A	-5.30	-5.00	-4.67	-4.50	-3.25	+0.40	0.70	1.40
	B	-5.30	-5.00	-4.67	-4.50	-3.25	+0.40	0.70	1.40
126	A	-4.55	-3.20	-0.30	+0.47	1.20	1.60	1.80	2.30
	B	-4.55	-3.20	-0.30	+0.47	1.20	1.60	1.80	2.30

UNIT		1%	5%	16%	25%	50%	75%	84%	95%
128	A	-4.95	-4.80	-4.65	-4.55	-3.85	-0.50	+0.55	+1.30
	B	-4.95	-4.80	-4.65	-4.55	-3.85	-0.50	+0.55	+1.30
143	A	+1.75	+2.00	2.23	2.35	2.60	2.90	3.07	3.43
	B	+1.75	+1.95	2.27	2.40	2.55	2.80	2.97	3.37
150	A	±0.00	+0.60	1.25	1.40	1.80	2.33	2.60	3.07
	B	±0.00	+0.57	1.25	1.40	1.80	2.33	2.65	3.10
151	A	-2.40	-0.27	+ 0.33	0.60	1.17	1.67	2.00	2.67
	B	-2.40	-0.30	+0.30	0.60	1.17	1.67	2.00	2.70
151 basal sand	A	+1.30	1.37	1.50	1.55	1.67	1.90	2.05	2.40
	B	+1.30	1.40	1.55	1.60	1.72	1.92	2.07	2.40

UNIT		1%	5%	16%	25%	50%	75%	84%	95%
152 B	A	+2.10	2.40	2.55	2.60	2.67	3.00	3.15	3.30
	B	+2.10	2.37	2.50	2.57	2.63	2.95	3.07	3.25
152 D	A	-3.70	-2.83	-1.90	-0.65	+1.45	2.23	2.55	3.20
	B	-3.70	-2.83	-1.90	-0.65	+1.45	2.27	2.60	2.23
154	A	-4.15	-3.80	-3.33	-2.60	-0.30	+0.97	1.23	1.57
	B	-4.15	-3.80	-3.33	-2.60	-0.30	+0.97	1.23	1.57
156	A	-0.70	+0.25	0.70	0.90	1.27	1.57	1.77	2.20
	B	-0.70	+0.25	0.75	0.90	1.27	1.55	1.70	2.20
157	A	-1.55	-0.55	+0.20	0.45	1.00	1.50	1.85	2.70
	B	-1.55	-0.65	+0.10	0.45	1.05	1.55	1.85	2.70

APPENDIX IV

Textural Parameters Summary Sheets

Key: Textural parameters used in this study are from the 'A' replicate cumulative curve. Those terms not defined in Table 2 are indicated below. They are included for comparative purposes.

σ_G= Graphic Standard Deviation $(\phi_{84}-\phi_{16})/2$

Q. D.= Phi Quartile Deviation= $(\phi_{75}-\phi_{25})/2$

	A				B			
UNIT	M_Z	σ_G	σ_I	Q.D.	M_Z	σ_G	σ_I	Q.D.
12	1.97	1.033	0.550	0.325	1.050	0.575	0.825	0.350
34	2.35	0.45	0.536	0.30	2.37	0.425	0.45	0.275
36	1.25	0.41	0.54	0.67	1.25	0.41	0.54	0.67
38 A	2.25	0.475	0.495	0.20	2.243	0.465	0.4749	0.175
38 B	1.733	0.65	0.6431	0.525	1.733	0.65	0.6280	0.525
38 C	2.083	0.63	0.629	0.425	2.097	0.64	0.643	0.45
47	0.517	0.80	0.968	0.425	0.517	0.80	0.968	0.425
50	1.650	0.775	0.789	0.465	1.650	0.775	0.777	0.450
54	1.70	0.575	0.5829	0.36	1.70	0.575	0.5829	0.36
55	1.460	0.475	0.537	0.275	1.467	0.475	0.537	0.265

UNIT	A				B			
	M_Z	σ_G	σ_I	Q.D.	M_Z	σ_G	σ_I	Q.D.
60	1.92	0.45	0.502	0.29	1.90	0.475	0.515	0.315
61	1.967	0.475	0.465	0.31	1.973	0.475	0.469	0.31
63	1.347	0.835	0.867	1.00	1.370	0.800	0.850	0.975
64	1.567	0.800	0.842	0.475	1.540	0.810	0.837	0.450
64 A	1.29	0.785	0.862	0.939	1.29	0.785	0.877	0.939
68	-2.24	2.515	2.2423	1.44	-2.24	2.515	2.2423	1.44
68 A	1.767	1.075	1.245	0.715	1.717	1.075	1.254	0.725
73	0.907	0.66	0.724	0.55	0.8900	0.685	0.752	0.56
74	2.000	0.55	0.639	0.375	2.017	0.55	0.631	0.373
75 A	-1.507	2.865	2.417	2.35	-1.507	2.865	2.417	2.35

UNIT	A				B			
	M_Z	σ_G	σ_I	Q.D.	M_Z	σ_G	σ_I	Q.D.
75 B	-0.857	2.35	2.069	1.74	-0.857	2.35	2.069	1.74
75 D	-2.567	2.65	2.317	1.90	-2.633	2.575	2.230	1.625
77	+0.363	1.56	1.618	0.90	0.340	1.56	1.624	0.925
78 B	-2.823	2.025	1.959	1.05	-2.823	2.025	1.944	1.05
78 A	1.057	1.100	1.133	0.75	1.047	1.085	1.136	0.76
79	-1.617	1.65	2.20	1.45	-1.617	1.65	2.20	1.45
80	-0.877	1.24	2.192	0.95	-0.910	1.265	2.178	0.95
81	-1.867	2.200	1.979	1.76	-1.850	2.225	1.9912	1.77
81 B	1.077	0.685	0.747	0.46	1.060	0.685	0.736	0.46
82 A	0.500	1.25	1.322	1.125	0.550	1.25	1.322	1.100

UNIT	A M_Z	A σ_G	A σ_I	A Q.D.	B M_Z	B σ_G	B σ_I	B Q.D.
83	0.383	0.625	0.5761	0.425	0.393	0.625	0.545	0.415
84	1.073	0.625	0.628	0.45	1.180	0.615	0.620	0.435
86	2.227	0.685	0.694	0.46	2.227	0.685	0.694	0.46
87	1.027	0.775	0.857	0.525	1.010	0.625	0.829	0.525
89	0.883	0.775	0.834	0.50	0.883	0.775	0.834	0.50
90 A	1.550	0.925	0.902	0.675	1.533	0.950	0.927	0.675
91 gravel	-0.967	2.35	2.046	1.76	-0.967	2.35	2.046	1.76
91 grit	0.35	0.675	0.815	0.40	0.35	0.675	0.830	0.41
92 B	1.467	0.475	0.510	0.225	1.490	0.45	0.498	0.200
93 A	0.317	1.025	1.096	0.65	0.290	1.050	1.116	0.675

	A				B			
UNIT	M_Z	σ_G	σ_I	Q.D.	M_Z	σ_G	σ_I	Q.D.
94	0.423	1.085	1.114	0.75	0.407	1.110	1.138	0.75
95 A	-1.627	2.615	2.224	2.25	-1.627	2.615	2.224	2.25
100	0.033	0.175	1.994	1.475	0.033	0.175	1.994	1.475
115 A	1.91	0.40	0.435	0.30	1.91	0.40	0.485	0.30
115 B	-1.40	2.63	2.23	2.27	-1.40	2.63	2.23	2.27
115 C	1.80	0.65	0.70	1.70	1.80	0.65	0.70	1.78
115 F	1.52	0.53	0.531	0.43	1.52	0.53	0.531	0.43
115 G	-3.50	2.60	2.427	2.625	-3.50	2.60	2.427	2.625
117	-2.51	2.685	2.312	2.45	-2.51	2.685	2.312	2.45
126	0.90	1.05	1.358	1.035	0.90	1.05	1.358	1.035

	A				B			
UNIT	M_z	σ_G	σ_I	Q.D.	M_z	σ_G	σ_I	Q.D.
128	-2.65	2.60	2.224	2.25	-2.65	2.60	2.224	2.25
143	2.633	0.42	0.427	0.275	2.597	0.35	0.458	0.20
150	3.07	0.675	0.712	0.465	1.90	0.700	0.733	0.465
151	1.167	0.835	0.863	0.535	1.157	0.85	0.879	0.535
151 basal sand	1.74	0.275	0.289	0.175	1.78	0.260	0.282	0.16
152 B	2.790	0.30	0.286	0.2000	2.733	0.285	0.276	0.190
152 D	0.70	2.225	2.026	1.44	0.717	2.250	2.043	1.46
154	-0.80	2.28	1.958	1.785	-0.80	2.28	1.954	1.785
156	1.247	0.535	0.565	0.335	1.240	0.475	0.533	0.325
157	1.017	0.825	0.905	0.525	1.00	0.875	0.850	0.550

APPENDIX V

Heavy Minerals Present Summary Sheets

Key: The heavy minerals in 16 samples in 3 size classes (in phi units) were classified into 7 groups. The ratio of opaque to nonopaque (O/N) was also determined in the Citronelle samples. Tabular data sheets of the Louisiana samples are also included. The data are presented in percentage form.

UNIT	SIZE CLASS	KYANITE	STAURO-LITE	RUTILE	TOURMA-LINE	ZIRCON	SILLI-MANITE	OTHER	O/N
5-F	1.0/2.0	38.42	30.04	1.47	17.24	0.98	11.33	0.49	28.50
	2.0/3.0	31.03	26.72	6.89	16.37	14.65	2.58	1.72	83.00
	3.0/4.0	11.46	15.28	4.45	7.64	56.68	2.54	1.91	81.50
18-B	1.0/2.0	43.21	35.67	0.00	9.54	0.00	11.55	0.00	16.00
	2.0/3.0	32.67	22.77	6.93	18.31	15.34	2.97	0.99	74.50
	3.0/4.0	13.00	11.50	9.00	9.00	54.50	1.50	1.50	81.50
18-D	1.0/2.0	60.32	20.10	0.00	11.34	0.51	7.22	0.51	17.46
	2.0/3.0	33.50	26.00	9.00	16.50	9.00	4.50	1.50	65.00
	3.0/4.0	21.70	7.75	7.14	20.15	37.20	3.87	2.32	81.50
60	1.0/2.0	48.51	27.22	1.98	15.84	3.46	0.99	1.98	19.00
	2.0/3.0	32.33	34.32	7.46	17.41	6.96	0.00	1.49	52.50
	3.0/4.0	16.50	15.00	13.00	5.00	48.50	1.00	1.00	56.00

UNIT	SIZE CLASS	KYANITE	STAURO-LITE	RUTILE	TOURMA-LINE	ZIRCON	SILLI-MANITE	OTHER	O/N
77	1.0/2.0	46.50	30.50	2.00	9.50	1.50	9.00	1.00	14.00
	2.0/3.0	48.00	24.00	8.00	11.00	3.50	3.00	2.50	46.00
	3.0/4.0	29.50	23.50	16.00	4.00	30.50	3.00	0.50	60.00
84	1.0/2.0	42.00	35.50	0.00	18.50	2.00	1.00	1.00	12.00
	2.0/3.0	39.50	30.00	6.55	18.55	5.00	0.50	0.00	45.00
	3.0/4.0	23.00	20.50	14.00	14.50	25.50	0.50	2.0	58.50
93-A	1.0/2.0	46.76	25.37	1.49	9.95	0.49	15.42	0.49	8.50
	2.0/3.0	42.57	20.29	14.35	8.91	5.94	7.92	0.00	29.00
	3.0/4.0	19.00	17.00	6.75	17.75	35.00	9.00	1.50	54.50
101-B	1.0/2.0	48.00	29.50	3.50	12.50	4.50	1.50	0.50	27.50
	2.0/3.0	30.34	15.92	7.96	6.95	37.81	0.00	0.99	60.50
	3.0/4.0	4.97	12.43	4.47	8.45	66.66	0.49	2.48	58.50

UNIT	SIZE CLASS	KYANITE	STAURO-LITE	RUTILE	TOURMA-LINE	ZIRCON	SILLI-MANITE	OTHER	O/N
109-B	1.0/2.0	53.50	25.50	1.00	9.00	0.00	11.00	0.00	20.50
	2.0/3.0	35.32	25.37	7.96	10.44	14.42	5.47	0.99	69.00
	3.0/4.0	7.50	8.50	5.00	1.50	74.50	0.50	2.50	81.00
130	1.0/2.0	47.00	34.00	1.00	10.00	0.50	4.00	3.50	24.50
	2.0/3.0	35.50	31.50	5.00	17.00	7.50	1.50	2.00	63.50
	3.0/4.0	13.00	12.50	10.50	59.00	3.50	0.50	2.00	31.50
137-B	1.0/2.0	00.00	00.00	00.00	00.00	00.00	00.00	00.00	00.00
	2.0/3.0	34.65	25.74	3.46	25.24	7.42	0.99	2.47	65.50
	3.0/4.0	10.00	15.50	6.50	7.00	58.50	2.50	0.00	67.50
138	1.0/2.0	64.29	14.29	0.00	19.64	0.00	1.78	0.00	71.00
	2.0/3.0	37.00	24.00	8.50	17.00	10.00	2.00	1.50	71.00
	3.0/4.0	15.00	13.50	4.50	6.00	56.50	1.50	3.00	83.50

UNIT	SIZE CLASS	KYANITE	STAURO-LITE	RUTILE	TOURMA-LINE	ZIRCON	SILLI-MANITE	OTHER	O/N
140	1.0/2.0	40.14	35.91	1.40	11.26	2.11	8.45	0.70	65.50
	2.0/3.0	28.85	26.36	2.98	25.87	8.95	3.98	2.98	60.00
	3.0/4.0	13.06	43.11	7.03	11.05	41.70	1.50	2.01	31.00
146	1.0/2.0	43.06	19.80	0.00	15.84	0.00	0.99	0.49	14.50
	2.0/3.0	51.50	23.50	2.50	17.00	3.00	2.50	0.00	28.50
	3.0/4.0	24.00	22.50	10.00	8.50	31.50	0.50	3.00	43.00
153	1.0/2.0	00.00	00.00	00.00	00.00	00.00	00.00	00.00	00.00
	2.0/3.0	38.00	23.00	1.50	29.00	4.00	2.00	2.50	44.50
	3.0/4.0	17.00	34.00	11.00	20.50	15.50	0.00	2.00	64.50
152-D	1.0/2.0	38.50	35.50	15.00	2.00	8.00	0.00	3.00	10.50
	2.0/3.0	28.50	22.00	13.00	7.00	26.00	0.00	0.50	35.50
	3.0/4.0	10.00	20.00	7.00	11.50	50.50	0.00	1.00	40.00

UNIT	KYANITE	STAURO-LITE	RUTILE	TOURMA-LINE	ZIRCON	SILLI-MANITE	AMPHIB. PYROX.	EPIDOTE	GARNET
200	13.33	19.33	0.33	17.00	2.00	6.00	17.33	3.00	1.00
201	24.67	34.67	5.67	13.67	8.00	6.33	1.33	----	0.33
202	29.33	16.67	1.33	31.00	----	16.33	-----	----	0.67
203	26.67	29.67	4.67	14.67	3.67	10.00	2.00	2.33	1.00
204	27.67	28.33	0.67	16.33	5.00	6.33	2.00	8.00	1.33
205	32.33	34.00	3.67	23.00	----	4.00	1.00	----	0.67
210	21.67	36.33	4.33	28.00	4.00	4.00	0.33	----	0.67
226	25.60	32.14	2.38	17.86	12.50	4.17	-----	----	----
228	26.33	28.00	2.00	26.00	----	13.33	-----	-----	----
229	37.33	13.00	----	27.00	----	10.00	-----	-----	----
232	41.33	25.67	4.33	11.67	5.67	8.33	-----	----	----
233	30.67	28.00	2.33	31.33	4.33	3.00	-----	----	----
235	30.33	25.00	0.33	37.33	1.33	3.67	-----	----	----
236	32.67	33.67	0.67	19.67	4.33	6.67	-----	----	----

UNIT	KYANITE	STAURO-LITE	RUTILE	TOURMA-LINE	ZIRCON	SILLI-MANITE	AMPHIB. PYROX.	EPIDOTE	GARNET
240	33.33	35.33	0.67	18.67	2.00	7.67	------	------	----
246	3.33	4.00	----	2.33	1.00	0.67	36.33	13.00	13.00
247	7.33	4.00	----	2.33	1.00	1.67	37.67	13.67	26.00

APPENDIX VI

K/K+S Summary Sheets

Key: The percentage of kyanite, staurolite, and the ratio k/k+s are presented in percentage form. Data are from two size classes and for each replicate analysis (A and B).

UNIT		2.0-2.5Ø KYANITE	STAUROLITE	K/K+S	2.5-3.0Ø KYANITE	STAUROLITE	K/K+S
12*	A	28.67	27.67	50.89	19.67	14.67	57.28
	B	28.67	27.67	50.89	19.67	13.67	59.00
34	A	31.00	5.67	84.55	21.00	9.00	70.00
	B	38.10	7.41	83.72	24.67	16.67	59.68
36	A	21.00	17.00	55.26	23.00	19.33	54.33
	B	28.67	33.00	46.49	23.33	16.33	58.82
38-A	A	28.00	25.00	52.83	10.67	13.33	44.44
	B	26.00	27.00	49.06	13.33	19.00	41.24
38-B	A	27.00	28.33	48.80	13.00	14.00	48.15
	B	32.67	27.67	54.14	16.00	14.33	52.75
38-C	A	27.20	18.40	59.65	12.00	16.67	41.87
	B	28.40	16.00	63.96	13.33	15.67	45.98

UNIT		2.0-2.5Ø KYANITE	2.0-2.5Ø STAUROLITE	2.0-2.5Ø K/K+S	2.5-3.0Ø KYANITE	2.5-3.0Ø STAUROLITE	2.5-3.0Ø K/K+S
50	A	33.67	24.67	57.71	26.33	23.00	53.38
	B	35.33	25.67	57.92	23.33	22.00	51.47
54	A	37.33	26.33	58.64	25.67	29.33	46.67
	B	34.67	28.00	55.32	29.33	27.67	51.46
55	A	36.00	24.00	60.00	37.33	24.00	60.87
	B	36.33	24.00	60.22	35.33	24.33	59.22
60	A	30.33	22.00	57.96	23.67	28.33	45.51
	B	31.67	23.00	57.92	21.00	26.67	44.05
61	A	39.00	26.00	60.00	24.67	27.33	47.43
	B	33.67	26.33	56.11	29.00	28.00	50.87
63	A	31.00	30.33	50.54	17.33	20.33	46.01
	B	29.00	27.33	51.47	20.33	21.67	48.41

UNIT		2.0-2.5Ø KYANITE	2.0-2.5Ø STAUROLITE	2.0-2.5Ø K/K+S	2.5-3.0Ø KYANITE	2.5-3.0Ø STAUROLITE	2.5-3.0Ø K/K+S
64	A	30.00	21.00	58.82	25.33	29.00	46.62
	B	31.00	26.67	53.75	33.00	27.00	55.00
64-A	A	35.33	30.00	54.08	22.33	18.33	54.91
	B	33.67	34.67	49.26	26.67	26.33	50.31
68	A	20.00	16.67	54.54	13.67	9.00	60.29
	B	23.33	17.00	57.85	8.67	11.00	44.06
68-A	A	27.00	25.33	51.59	21.33	17.33	55.17
	B	30.33	19.67	60.66	22.00	18.00	55.00
73	A	24.00	24.67	49.31	17.67	15.33	53.53
	B	29.00	25.67	53.04	17.33	24.67	41.26
74	A	33.67	32.33	51.01	23.67	24.33	49.30
	B	------	------	------	23.67	22.33	51.44

		2.0-2.5Ø			2.5-3.0Ø		
UNIT		KYANITE	STAUROLITE	K/K+S	KYANITE	STAUROLITE	K/K+S
75-A	A	22.33	25.33	51.90	26.33	20.00	56.83
	B	27.33	23.67	53.59	27.67	24.67	52.87
75-B	A	27.33	26.67	50.61	21.67	17.33	55.56
	B	32.67	24.67	56.98	21.00	17.33	54.78
75-D	A	26.00	20.67	55.71	16.33	13.67	54.44
	B	23.67	22.00	51.82	21.67	11.33	65.66
77	A	32.33	28.67	53.00	26.33	17.67	59.84
	B	34.33	25.67	57.22	31.67	16.67	65.97
78	A	24.67	19.33	56.06	19.33	17.33	52.72
	B	25.00	29.00	46.29	20.67	15.67	56.88
78-A	A	21.33	19.67	52.03	21.00	19.67	51.63
	B	24.33	17.33	58.40	26.00	18.67	58.20

UNIT		2.0-2.5Ø KYANITE	STAUROLITE	K/K+S	2.5-3.0Ø KYANITE	STAUROLITE	K/K+S
79	A	29.67	23.33	55.97	18.33	22.33	45.08
	B	30.00	25.33	54.22	17.33	18.00	49.06
80	A	32.66	26.67	55.05	14.67	19.00	43.56
	B	26.00	32.00	44.82	14.00	17.67	44.21
81-A	A	22.33	19.00	54.03	15.33	14.33	51.68
	B	31.00	25.33	55.02	16.67	18.33	47.61
81-B	A	37.67	17.00	68.90	25.67	19.67	56.62
	B	33.67	22.00	60.48	22.67	21.33	51.51
82-A	A	33.00	25.33	56.57	32.00	25.67	55.49
	B	35.00	17.67	66.46	30.00	19.33	60.81
83	A	38.00	24.00	61.29	26.67	18.00	59.70
	B	34.00	27.33	55.43	24.33	18.00	57.48

		2.0-2.5Ø			2.5-3.0Ø		
UNIT		KYANITE	STAUROLITE	K/K+S	KYANITE	STAUROLITE	K/K+S
84	A	35.00	32.00	52.24	28.33	29.33	49.13
	B	37.67	27.00	58.25	34.33	23.67	59.20
86	A	41.33	20.33	67.03	26.33	20.67	56.03
	B	36.00	21.67	62.43	29.33	22.00	57.14
87	A	33.67	25.33	57.06	24.33	19.67	55.30
	B	32.00	22.67	58.54	22.67	20.67	52.31
88	A	30.00	24.33	55.21	25.33	30.00	45.78
	B	32.00	21.00	60.38	30.00	24.00	55.56
89	A	31.33	28.67	52.22	24.33	20.00	54.89
	B	32.33	27.00	54.49	21.67	21.67	50.00
90-A	A	31.67	19.33	62.09	21.33	20.67	50.79
	B	40.00	17.33	69.77	31.67	18.33	63.33

		2.0-2.5Ø			2.5-3.0Ø		
UNIT		KYANITE	STAUROLITE	K/K+S	KYANITE	STAUROLITE	K/K+S
91	A	29.67	31.00	48.90	25.67	17.33	59.69
	B	34.00	23.33	59.30	25.67	20.67	55.40
92-B	A	33.33	23.33	59.88	29.00	19.33	60.00
	B	34.67	22.67	60.47	26.00	24.33	51.66
93-A	A	27.00	29.00	48.21	24.00	19.33	55.38
	B	23.33	27.33	46.05	23.67	16.33	59.17
94	A	31.00	29.33	51.38	24.33	21.00	53.68
	B	33.33	29.00	53.48	26.67	22.33	54.42
95-A	A	12.69	15.37	45.24	32.28	23.81	57.55
	B	24.35	26.44	47.94	16.14	12.43	56.48
100	A	27.33	33.67	44.81	18.33	19.33	48.67
	B	28.00	31.67	46.93	18.33	25.00	42.31

UNIT		2.0-2.5Ø KYANITE	STAUROLITE	K/K+S	2.5-3.0Ø KYANITE	STAUROLITE	K/K+S
115-A	A	22.00	19.67	52.80	19.33	22.67	46.03
	B	19.67	24.67	44.36	18.67	20.33	47.86
115-B	A	23.33	31.00	42.94	17.00	16.00	51.51
	B	24.67	31.33	44.05	21.00	13.33	61.17
115-C	A	18.33	26.67	40.74	17.67	24.33	42.06
	B	20.67	22.33	48.06	23.67	20.00	54.20
115-F	A	19.67	13.00	60.20	27.33	20.00	57.75
	B	30.00	16.00	65.22	26.33	13.67	65.83
115-G	A	20.67	34.00	37.80	12.67	18.67	40.43
	B	27.00	29.67	47.65	15.67	15.33	50.54
117	A	24.00	30.00	44.44	13.67	13.33	50.62
	B	26.00	25.67	50.32	12.33	13.33	48.05

UNIT		2.0-2.5Ø			2.5-3.0Ø		
		KYANITE	STAUROLITE	K/K+S	KYANITE	STAUROLITE	K/K+S
126	A	32.00	25.67	55.49	17.33	21.67	44.44
	B	32.67	28.33	53.55	22.00	21.33	50.77
128	A	20.67	30.00	40.79	19.33	14.67	56.86
	B	28.00	24.67	53.16	21.00	13.33	61.17
143	A	33.33	20.67	61.73	14.33	20.33	41.35
	B	31.00	20.33	60.39	17.33	23.00	42.97
150	A	32.67	25.33	56.32	24.67	21.67	53.24
	B	39.33	22.00	64.13	25.33	27.00	48.41
151-A	A	24.33	23.33	51.05	17.33	15.67	52.53
	B	30.00	20.33	59.60	14.00	18.67	42.86
151-B	A	33.33	26.67	55.56	23.67	29.33	44.65
	B	33.33	27.33	54.95	24.67	25.33	49.33

UNIT		2.0-2.5∅ KYANITE	STAUROLITE	K/K+S	2.5-3.0∅ KYANITE	STAUROLITE	K/K+S
152-B	A	19.48	24.68	44.12	21.67	12.33	63.73
	B	26.80	19.72	57.58	14.67	11.33	56.41
152-D	A	20.67	18.00	53.45	15.00	14.00	51.72
	B	24.00	24.00	50.00	15.00	16.33	47.87
154	A	24.00	26.33	47.68	29.67	24.67	54.60
	B	35.00	28.33	55.26	24.67	27.33	47.43
156	A	31.00	27.33	53.14	22.33	23.00	49.26
	B	30.67	22.67	57.50	22.00	21.33	50.77
157	A	30.00	22.33	57.32	25.00	20.00	56.52
	B	34.00	24.33	58.28	29.00	20.67	58.39
	A						
	B						

APPENDIX VII

Summary of Analysis of Variance Procedures

The purpose of this summary is to briefly state what analysis of variance (ANOV) is, and the steps used in calculating the ANOV data tables presented in the text of this report. A more thorough discussion of ANOV theory (and the F-test), procedures, and applications can be found in most statistical textbooks (e.g., Steele and Torrie, 1960).

ANOV allows for the division into components of the total variance present. Using the F-test, the components can be tested for statistically significant differences; i.e., are the differences between observed values greater than that which could be attributed to random chance.

For example, each unit of the Citronelle contains a suite of heavy minerals. Two observations per unit allow an estimate to be made of the internal variation associated with each unit. Once this is done, it can be statistically calculated as to whether the variation between units at a locality is significantly greater than the variation within units. The latter variation is termed experimental error and is a measure of the internal homogeneity of the samples, provided all samples are collected in the same manner, are treated in the laboratory in the same manner, and the heavy minerals are identified by uniform criteria. For geologic reasons, the value tested was kyanite/kyanite + staurolite (k/k+s). Because this yields a percentage figure, which is a ratio, the calculated values may or may not be normally distributed. For this reason, the arc sine transformation was used (see Steele and Torrie, 1960, for additional information on this procedure). The steps in calculating the transformed data in Tables 3, 4 , and 5 are as follows:

(1) The individual values of each observation, x, for all units at one locality are summed. The sum is squared and then divided by the total number of observations, n. This value is termed C. $C=\sum(x)^2/n$.

(2) The individual values of each observation for all units at one locality are squared and then summed. C is subtracted from this total; the resultant figure is termed the corrected total sum of squares ($SS_t=\sum(x^2)-C$).

(3) The two values for each unit are summed, squared, and divided by two. The resultant values for each unit at one locality are added and C is subtracted from their total. this value is termed treatment sum of squares (in this case SS_b, b indicating between units; treatment in this example is the division of the outcrop into recognizable units).

(4) $SS_t-SS_b=SS_e$, sum of squares of error term (in this study, SS_w, variation within a unit).

(5) Degrees of freedom (df) refers to the number of independent variables affecting a value and equals the number of observations minus one. For example, if a locality has 5 units, it has 10 observations (two per unit) and the total df (df_t)= 9. The df between units (df_b) is the number of units minus one, so that df_b=4. Subtracting,

$df_t - df_b = df_w$, the degrees of freedom associated with internal variation.

(6) $SS_b/df_b = MS_b$, and $SS_w/df_b = MS_w$ (MS= mean square), the amount of variation associated with "between units" and "within units", respectively.

(7) The F-test allows the following question to be answered: is MS_b significantly greater than MS_w. $F = (SS_b/df_b)/(SS_w/df_w) = (MS_b/MS_w)$. If the calculated value of F is less than a certain critical value, *F, the answer is no, and differences due to internal variation are greater than differences between units. Tables of *F already calculated are found in numerous statistical textbooks. The value of *F depends upon (a) the number of df in the numerator and denominator, and (b) the confidence limit desired. The confidence limit designation 0.05 indicates that the calculated value will exceed the critical value due to random chance 5 times out of 100. This is a commonly used confidence limit because if a smaller value is used, the possibility of not recognizing significant variation also increases.

The data in the other ANOV tables were calculated in basically the same manner.

VITA

Norman Charles Rosen was born in Cleveland, Ohio, on October 8, 1941. He received his secondary education in Cleveland Heights, Ohio, and was graduated from Cleveland Heights High School in June, 1959.

While at The Ohio State University, he served as Vice-President and President of the Geology Club, treasurer of Phi Epsilon Pi social fraternity, and held a Texaco scholarship in geology for two years. He received his B. S. degree in March, 1963. He was accepted as a graduate student at The Ohio State University, and received his M. S. degree in June, 1964.

He entered Louisiana State University in September, 1964 as a candidate for the Ph. D. degree, and was graduated in January, 1968.

He has had the good fortune of being married to Rashel Nikravesh since August 22, 1964.

EXAMINATION AND THESIS REPORT

Candidate: Norman C. Rosen

Major Field: Geology

Title of Thesis: Heavy Minerals of the Citronelle Formation of the Gulf Coastal Province.

Approved:

C. O. Durham Jr. E. J. Ofman

Major Professor and Chairman

Max Goodrich

Dean of the Graduate School

EXAMINING COMMITTEE:

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Date of Examination:

December 15, 1967